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ABSTRACT

A case study of the Suburban Library System (SLS) was conducted by applying an analytical library network model to data collected during March 1978. Models are developed for describing the intralibrary processing activities encountered at SLS and the other resource libraries in this case study. Alternative routing policies for referring requests among resource libraries are generated as a function of probability of satisfaction and waiting time. Constraints on the order of resource libraries in a referral route are also considered in generating alternative policies. Recommendations suggest specific changes in the reserve and purchase procedures at SLS which are predicted to improve overall network performance. (Author)

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# APPLICATION OF A LIBRARY NETWORK MODEL:

## A Case Study of the Suburban Library System

Project Report No. 9 In A Series Entitled:

A Mathematical Model of the Illinois Interlibrary Loan Network

Submitted to

Illinois State Library

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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December 1978

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

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# FOREWORD

This report is based on an application of a library network model to the Suburban Library System. Data collection occurred during the month of March 1978 regarding the internal processing and routing of interlibrary loan requests. Two models are developed for describing the intralibrary processing activities encountered at Suburban Library System and resource libraries in this case study. Alternative routing policies for referring requests among resource libraries are also analyzed. A recommended routing policy is suggested which predicts an average of 34.5% improvement in turnaround time and 16.3% reduction in the resource libraries' processing load. The internal procedures for purchase and reserve requests which are found on-shelf elsewhere in the network are identified as possible areas where further improvements at Suburban Library System can be realized. The results reported were supported under the Illinois State Library.

I would like to acknowledge the people who helped throughout the course of this case study. Mrs. Katherine Gesterfield, Director of the Illinois State Library, without whose funding this case study would never have been possible. Mr. Lester Stoffel, Director of the Suburban Library System who graciously allowed us to study his Library System. Mrs. Susan Hesse contributed greatly to my understanding of the internal procedures employed during the time of this case study at Suburban Library System. Mrs. Marilyn Hall enthusiastically

cooperated in preparing the many data collection forms which were essential to our analysis. Carolyn Robins, the technical assistant to the project, was responsible for interpreting and entering all the data. She also provided editorial expertise in preparing this computer generated report.

# APPLICATION OF A LIBRARY NETWORK MODEL: A CASE STUDY OF THE SUBURBAN LIBRARY SYSTEM


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# Chapter One

## INTRODUCTION AND SUMMARY

This case study is an application of the Illinois Library and Information Network (ILLINET) model to analysis of the Suburban Library System Interlibrary Loan service (SLS ILL). The purpose of this study is to provide a clear description of how the Suburban Library System processes interlibrary loan requests and then, to offer recommendations for possible improvements. In Chapter Two we describe the general policies of SLS for handling interlibrary loan requests. Specific procedures describing the SLS ILL internal process are included in Appendix A.

With a clear and unambiguous description of the internal procedures used at SLS ILL, we are able to identify the data required to form the parameters of the model. Chapter Two defines the data used in this study as well as provides empirical results obtained from the resulting data base. Data was collected for all interlibrary loan requests initially received at SLS during March 1978. Of the 7033 requests initiated during March, 6567 requests were received by the investigators by October 20, 1978 for data entry and analysis. The remaining 466 requests were not located by SLS. Discussion with SLS staff resulted in the assumption that final action was taken on these requests as either cancelled (i.e., unsatisfied) or satisfied as opposed to "pending." The reason for not receiving the forms for data entry is that the forms were misplaced or discarded by mistake. We received 136 pending requests which are assumed to

represent all requests which were still in process by September 15, 1978. Appendix B includes a discussion concerning assumptions made during the data entry process. In Appendix C, we have produced tables of demand by subject class and publication date.

Formation of the model's parameters is described in Chapter Three. Based on these parameters the model predicts network performance measures for alternative routing policies. Network performance measures are defined as probability of satisfying a request, average waiting time from initiation of a request until receipt of the desired item, average total and unit costs, and average demand throughout the network. Particular emphasis is placed on modeling the internal processing activity at SLS ILL.

In Chapter Four we discuss some alternative routing policies and analyze the results. Chapter Five provides the recommendations and conclusions of the report.

## Brief Overview of ILLINET

Before we describe the interlibrary loan operation at SLS ILL, we will first provide a brief description of the Illinois Library and Information Network (ILLINET). ILLINET provides a range of library-related services, the most extensive of which is interlibrary loan and reference services. The network is hierarchical in structure, i.e., requests in general travel vertically in the network as they seek satisfaction, and includes four levels: local libraries, Cooperative Library Systems,

Research and Reference Center Libraries, and Special Resource Centers. Figure 1.1 is a block diagram representing the general flow of requests among the levels of the network.

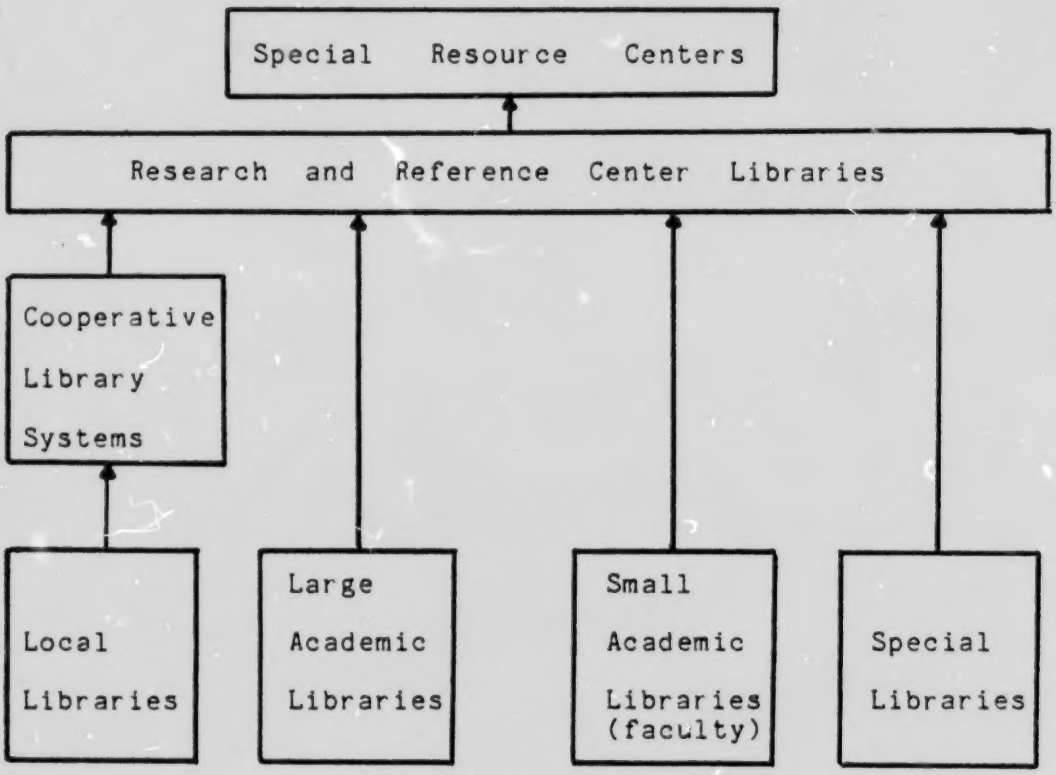



Figure 1.1 ILLINET: Overall Flow of Requests

At the local library level, patrons request documents, microforms, and audio-visual materials which for one reason or another may not be available in the local library collection. The local library level constitutes a multitype library network of over 1100 libraries representing public libraries, academic libraries, special libraries, and school libraries/media centers. The resources of these local libraries are extended through the availability of additional library collections within ILLINET.

At the System level there exist 18 geographically-dispersed Cooperative Library Systems. In addition to the 18 Cooperative Library Systems, there are other libraries in the network which can directly communicate with the Center level. These libraries include both academic and special libraries. Because the number of requests initiated by each of these libraries represents a relatively small percentage of the total network demand, it is convenient for purposes of analysis to aggregate these requests by library type. In Figure 1.1 we refer to these libraries as: Large Academic Libraries, Small Academic Libraries, and Special Libraries.[1] Some of the libraries fall within the constituency of a Library System and may refer their requests to the appropriate System for access to the Center level. However, in general, these three categories of libraries function like Library Systems because they can communicate directly with the Center level. Thus, in Illinois we can say there are effectively 21 Library Systems forwarding requests to the Center level. In this report, we are analyzing only one of these Systems, namely, Suburban Library System.

In general, each System administers resource sharing for its constituent libraries and serves as the entrance point to ILLINET. For example, when a request unfilled by the local

[1]Large Academic Libraries are identified as those with collections over 200,000 volumes; Small Academic Libraries represent faculty requests of Small Academic Libraries with less than 200,000 volumes; Special Libraries are identified as Special Libraries which are affiliate members of ILLINET.

library is received by the respective System, there are four possible outcomes:

1. document is located and request is filled by a member library in the System
2. document is located and request is filled by another Cooperative Library System
3. request is referred to the Center level
4. request is returned unfilled to the local library.

An unfilled request returned to the local library may indicate that verification problems precluded adequate bibliographic identification; the item was on order and should be requested again at a later time; the request was considered inappropriate, for example, best sellers are not usually honored in interlibrary loan; or, perhaps the patron imposed a deadline which could not be met by System interlibrary loan staff.

A request that is forwarded to the Center level can be processed in two ways. First, it can be sent to a Center with the specification that, if that Center cannot satisfy the request, the request should be sent back to the Library System. Alternatively, the request can be sent to a Center with the specification that, should the request not be satisfied, it should be forwarded to another Center. These two types of requests are called direct and referred requests, respectively. Requests may be satisfied by the first Center encountered, or unsatisfied requests may require processing by multiple Center

libraries. The number of resource libraries which can potentially process a request and the sequence of particular resource libraries chosen define the request routing policy.

Referring once again to Figure 1.1, we can see that requests referred to the Special Resource Centers must first be processed by the Center level. The Center Libraries consist of Chicago Public Library (CPL), Illinois State Library (ISL), Southern Illinois University/Carbondale (SIU), and the University of Illinois at Urbana-Champaign (UOI). Communication among the four Research and Reference Center Libraries does not occur in a predetermined order and every Center can communicate with every other Center. The Center Libraries generally communicate via TWX (i.e., teletype).

As of this writing there are three Special Resource Centers: John Crerar Library, Northwestern University, and University of Chicago. Requests received by these libraries from ILLINET must be forwarded by one of the Center libraries. Further, requests received at Northwestern or University of Chicago must be referred by the Illinois State Library or the University of Illinois. Communication between the Center Libraries and Special Resource Libraries is usually via TWX.

Communication between the local libraries and Library Systems is facilitated by mail, telephone, automated circulation files, and delivery vans. The Systems in general use TWX processing as well as telephone and mail for forwarding requests to the Center level. Requests for interlibrary loan are also

communicated via the computerized circulation systems (CLSI) available at some libraries. At the time of this case study, four Library Systems were using CLSI for querying each other's collection and placing a hold for books on the shelf. One of the Center libraries, the Illinois State Library, also uses CLSI and has the capability of querying the data bases of the participating Systems in the Network. Thus, this activity occurs both within the System level and between the System and Center levels.

Implementation of CLSI encourages lateral communication in the Network which in general is described as a hierarchical structure. Communication between the System and Center levels of the Network is rapidly changing with the introduction of CLSI. Without CLSI access, System Libraries in general obtain location information from the microform book catalogs of the State Library, University of Illinois at Urbana-Champaign, and Southern Illinois University. Routing requests without location information is usually based on the interlibrary loan librarian's knowledge of the subject strengths of the Center level library collections. Those Library systems with CLSI generally use the book catalogs as a last resort to ILLINET holdings. Their access to the Center level is expedited by the connection via CLSI to the State Library collection. Future plans include expansion of CLSI to other libraries in the Network as well as access to an automated circulation system (i.e., LCS) for the library collection at the University of Illinois at Urbana-Champaign. Thus, while the protocols in the Network in general describe a

hierarchical arrangement, the implementation of computer technology is changing the structure of the Network at the System and Center levels. With this brief overview in mind, we will now proceed with a description of the interlibrary loan service at the Suburban Library System which engages in extensive use of multiple circulation files supported by CLSI.

# Chapter Two

# STUDY PLAN

## Suburban Library System: Service and Resources

Suburban Library System is one of 18 regional Cooperative Library Systems in ILLINET. It is located in the Chicago suburb of Burr Ridge, Illinois. The System consists of 102 member libraries representing a multi-type library network: 74 public libraries ; 12 academic libraries; and 16 special libraries. Table 2.1 identifies all of the SLS member libraries by name and standard abbreviation. Note that this table actually lists 106 member libraries because the following requesting libraries, which are not generally counted as member libraries, generated requests during March 1978: SLS ILL, SLS Bookmobile, SLS Information Service, and Northern Illinois Library System.

A range of library services are provided by the SLS staff to its member libraries. This report focuses on one aspect of SLS, namely the Interlibrary Loan service. One important characteristic about the Interlibrary Loan service is that 14 of the SLS member libraries' collections are accessed through a computerized circulation system (CLSI). Table 2.2 identifies the libraries and 4 data bases which provide access to the SLS member library collections at the time of this case study.[1] SLS also has

[1]After the initiation of this study, Blue Island Public Library was added to one of the Cluster data bases. Since data for searching the Blue Island circulation file was not indicated on any request form received for this study, we did not include Blue Island as a CLSI file in our analysis.

access through CLSI to 3 other Library Systems' holdings (i.e., Northern Illinois Library System, North Suburban Library System, and Rolling Prairie Library System) as well as the Illinois State Library.

SLS ILL handles author/title and very specific types of non-author/title requests. In addition to specific author/title requests, SLS ILL processes requests for any book by a specified author (i.e., specific author, no specific title) and requests for any book written in a specific foreign language. Information requests are handled by the SLS Information Service which is located in the Oak Lawn Public Library. Since the processing of information requests is separate from ILL requests, SLS member libraries are instructed to send their requests to the appropriate location. On occasion, SLS ILL will not be able to satisfy some requests and rather than cancel the request, they may decide to send the requests to the SLS Information Service. These requests typically require some decision regarding a substitute title or edition which the patron has indicated as acceptable. Upon completing the identification of an appropriate author/title, the Information Service will return the request to SLS ILL for normal processing.

## MEMBER PUBLIC LIBRARIES

| | |
|---|---|
| ADS | Acorn Library District (Oak Forest) |
| AMS | Alsip-Merrionette Park Public Library District |
| BPS | Bedford Park District Library |
| BWS | Bellwood Public Library |
| BKS | Berkeley Public Library |
| BYS | Berwyn Public Library |
| BIS | Blue Island Public Library |
| BVS | Bridgeview Public Library |
| BRS | Broadview Public Library |
| BFS | Brookfield Public Library |
| CCS | Calumet City Public Library |
| CHS | Chicago Heights Public Library |
| CRS | Chicago Ridge Public Library |
| CLS | Clarendon Hills Public Library |
| COS | Grande Prairie Public Library |
| CWS | Crestwood Public Library District |
| CTS | Crete Public Library |
| DOS | Dolton Public Library |
| DGS | Downers Grove Public Library |
| ECS | East Chicago Heights Library District |
| ESS | Eisenhower Public Library District (Harwood Heights & Norridge) |
| EHS | Elmhurst Public Library |
| EPS | Elmwood Park Public Library |
| EVS | Evergreen Park Public Library |
| FCS | Flagg Creek Public Library |
| FMS | Flossmoor Public Library |
| FPS | Forest Park Public Library |
| FRS | Frankfort Public Library District |
| GWS | Glenwood Public Library District |
| GHS | Green Hills Public Library District (Palos Hills & Hickory Hills) |
| HAS | Harvey Public Library |
| HSS | Hillside Public Library |
| HDS | Hinsdale Public Library |
| HKS | Hodgkins Public Library District |
| HTS | Hometown Public Library |
| HWS | Homewood Public Library |
| LGS | LaGrange Public Library |
| LPS | LaGrange Park Library District |
| LSS | Lansing Public Library |
| LDS | Lisle Library District |
| LYS | Lyons Public Library |
| MCS | McCook Public Library District |
| MKS | Markham Public Library |
| MTS | Matteson Public Library |

Table 2.1 SLS Member Libraries and Codes
(continued)

| | |
|---|---|
| MWS | Maywood Public Library |
| MPS | Melrose Park Public Library |
| MDS | Midlothian Public Library |
| NLS | Northlake Public Library District |
| OLS | Oak Lawn Public Library |
| OPS | Oak Park Public Library |
| ORS | Orland Park Public Library |
| PHS | Palos Heights Public Library |
| PFS | Park Forest Public Library |
| PSS | Park Forest South Library District |
| ROS | Robbins Public Library District |
| RFS | River Forest Public Library |
| RGS | River Grove Public Library |
| RDS | Riverdale Public Library District |
| RSS | Riverside Public Library |
| RPS | Richton Park Public Library District |
| SVS | Sauk Village Library District |
| SPS | Schiller Park Public Library |
| SHS | South Holland Public Library |
| SSS | Prairie Trails Public Library |
| SFS | Stickney-Forest View Library District |
| SAS | Summit-Argo Public Library |
| SBS | SLS Bookmobile |
| SLS | SLS ILL |
| STS | Steger-South Chicago Heights District |
| THS | Thornton Public Library |
| TPS | Tinley Park Public Library |
| TFS | Thomas Ford Memorial Library (Western Springs) |
| WCS | Westchester Public Library |
| WMS | Westmont Public Library |
| WRS | Woodridge Public Library |
| WOS | Worth Public Library District |

MEMBER ACADEMIC LIBRARIES

| | |
|---|---|
| CTC | Concordia Teachers College |
| ELC | Elmhurst College |
| GWC | George Williams College |
| GSU | Governors State University |
| IBC | Illinois Benedictine College |
| MVC | Moraine Valley Community College |
| MOC | Morton College |
| PSC | Prairie State College |
| ROC | Rosary College |
| THC | Thornton Community College |
| TCC | Trinity Christian College |
| TRC | Triton College |

Table 2.1 SLS Member Libraries and Codes (continued)

## MEMBER SPECIAL LIBRARIES

| | |
|---|---|
| ACA | Alberto Culver |
| ARA | Argonne |
| AMA | Armak |
| BSA | Bell System |
| CHA | Christ Hospital |
| CIA | CPC International |
| ESA | Evangelical School Nursing |
| IMA | Ingalls Memorial Hospital |
| JMA | John J. Madden Mental Health Zone Center |
| IPA | Inolex Pharmaceutical |
| MAA | Morton Arboretum |
| OFA | Oak Forest Hospital |
| OSA | Olympic Savings & Loan |
| SFA | St. Francis Hospital |
| SGA | South Suburban Genealogical & Historical Society |
| TPA | Tinley Park Mental Health Center |

## OTHER

| | |
|---|---|
| NIL | Northern Illinois Library System |
| SLS | SLS Information Service |

Table 2.1 SLS Member Libraries and Codes

OPS Data Base

| | | |
|---|---|---|
| 1. | SLS | Suburban Library System |
| *2. | OPS | Oak Park |
| 3. | ESS | Eisenhower |
| 4. | EPS | Elmwood Park |

PFS Data Base

| | | |
|---|---|---|
| *1. | PFS | Park Forest |
| 2. | HAS | Harvey |
| 3. | DOS | Dolton |
| 4. | FRS | Frankfort |

EHS Data Base

| | | |
|---|---|---|
| 1. | EHS | Elmhurst |
| 2. | NLS | Northlake |
| 3. | DGS | Downers Grove |

OLS Data Base

| | | |
|---|---|---|
| 1. | OLS | Oak Lawn |
| 2. | AMS | Alsip |
| 3. | LSS | Lansing |

*Indicates Headquarters Library where part of the SLS collection is housed.

Table 2.2 SLS CLSI Cluster

A major portion of the requests satisfied by the System are filled by books housed in the Oak Park Public Library and the Park Forest Public Library. These two libraries are generically

referred to as Headquarters Libraries. The Headquarters Libraries' collections serve the needs of their respective local clientele and further, represent a major portion of the System collection. SLS ILL maintains an on-demand collection to back up the interlibrary loan activity. This collection consists of current items purchased to fill interlibrary loan requests. When the demand for an item has passed, the books are then sent to a Headquarters Library.

We will first describe some general principles used by the System in attempting to satisfy an ILL book request. The overall sequence and specific resources available to SLS ILL are identified before we describe the specific procedures implemented by SLS ILL during the time of this study.

The System receives approximately 5000-6000 requests for interlibrary loan per month from its member libraries. An attempt is made to satisfy each request from the SLS collection and its combined member library collection. System holdings are determined by accessing the CLSI Cluster data bases and the SLS Union Catalog, which is a card catalog used primarily for determining the holdings of member libraries not included in the CLSI data bases. If the item is not located in any SLS member library collection, an attempt to satisfy the request is made by accessing the collections of 3 other Library Systems and the Illinois State Library through the CLSI Interconnect. The portion of requests which are either not located at any library or unavailable are then considered for processing at the Research

and Reference (R and R) Center level of ILLINET. Requests sent to the Center level of the network may be filled by one of the Center Libraries or Special Resource Libraries. These requests may be processed by one or more of the following libraries:

Center Libraries

Chicago Public Library (CPL)
Illinois State Library (ISL)
Southern Illinois University (SIU)
University of Illinois at Urbana-Champaign (UOI)

Special Resource Libraries

John Crerar Library (JCL)
Northwestern University (NWL)
University of Chicago (UCL)

Requests at this stage which remain unfilled may be sent to additional libraries, provided their location is identified through some national union catalog (e.g., OCLC, or NUC). These requests are sent under the provisions of the National Interlibrary Loan Code of 1968. Figure 2.1 illustrates a general overview of the levels of resources accessed by SLS ILL.

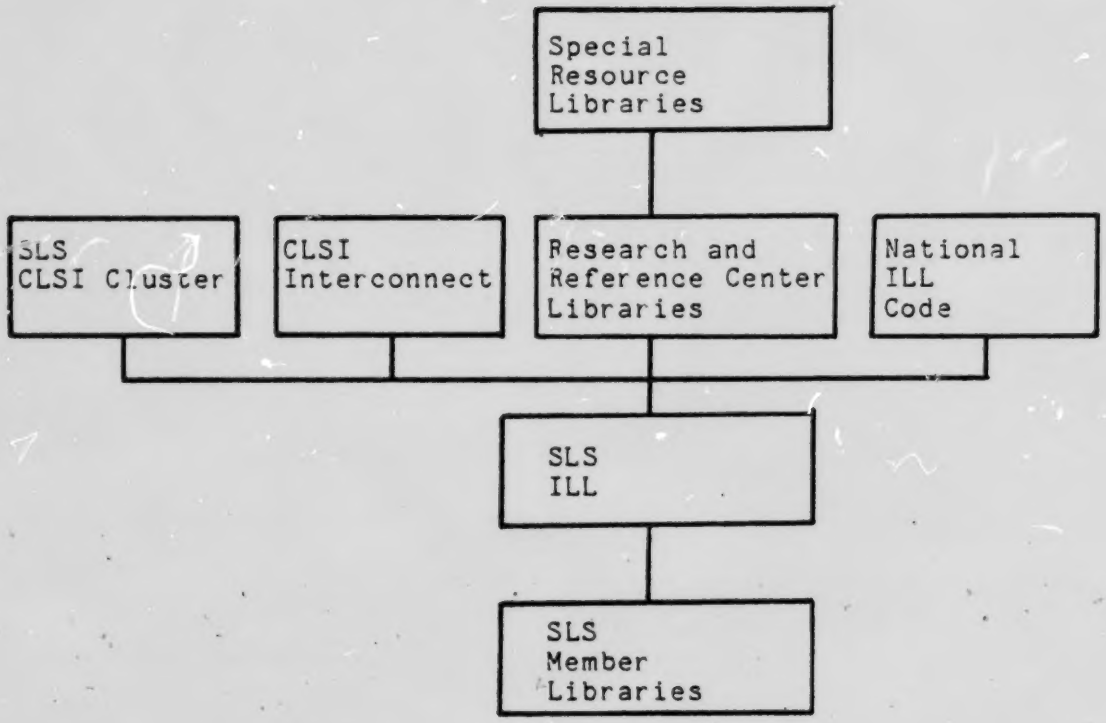



Figure 2.1 Interlibrary Loan Resources Accessed by SLS ILL

Before we proceed with the generalized description of the SLS ILL procedures we will briefly describe SLS's use of CLSI for interlibrary loan requests. CLSI enables SLS ILL to identify the library which owns a particular item. In addition to ownership status, CLSI also provides the circulation status for each item entered in the data base. With ownership and availability data provided through online access, CLSI should help SLS ILL to reduce the probability of sending a request for an unowned item or an unavailable (i.e., circulating) item.

SLS currently houses 4 minicomputers which store and maintain the 4 SLS Cluster data bases. Each library with its collection on a data base has a direct line access to the

computer maintaining its data base. These libraries are thus able to continuously update the circulation status of their collections. (With the exception of Lansing and Frankfort, all libraries indicate the circulation status of their holdings.) These libraries may also access their cluster data base to locate a patron's book request which they do not own. For example, Downers Grove Public Library may find, as a result of searching the EHS data base, that Elmhurst Public Library owns the item. Downers Grove is then able to request the item from Elmhurst and will place a hold via CLSI.

Cross data base searching by SLS members (i.e., across clusters) was not technically possible at the time of this study. Because the computers are not located at the individual libraries represented in the cluster data bases and remote printers are not available, request notices are not automatically produced at the lending library locations. Thus, all CLSI notices are produced at SLS ILL and delivered daily by van to the resource library generating the request notice.

Due to heavy usage and limited telecommunications support for simultaneous CLSI access by remote terminals, access to the CLSI Interconnect data bases must be scheduled.[2] SLS ILL is

[2]SLS is planning to increase the number of telephone lines which can be supported by the CLSI Cluster data base computers in order to provide simultaneous access to the data bases.

scheduled to access their Cluster data bases in the morning until 11:00 a.m. Between 11:00 a.m. and 1:00 p.m. they have access to each of the CLSI Interconnect data bases at half hour intervals. From 1:30 p.m. until the end of the day, SLS ILL has access to their Cluster data bases. Requests received in the mail are searched through the SLS Cluster data bases and the Interconnect data bases, as necessary, within 24 hours of receipt.

SLS ILL Internal Processing

The general activities pursued at SLS ILL for processing book, periodical, and census microfilm requests are described in this section. Detailed discussion of the procedures appears in Appendix A. Based on the detailed description and analysis of the data collected for this case study, we are able to develop a model of the processing activities at SLS ILL. Development of this intralibrary model is discussed in Chapter Three.

Most internal interlibrary loan processes can be described in terms of six basic activities. Some variation and modification of these activities can be adapted to the specific library of interest. SLS ILL processes book, periodical, and census microfilm requests, and all of these requests encounter some combination of the following activities:

1. IP in-processing of request
2. S search of catalog
3. O obtain item from shelf

4. V verification
5. OP out-processing of item to patron
6. F forward request to referral library, or return to patron.

The in-processing activity includes procedures for the initial receipt of the request, such as opening the mail and sorting for appropriate distribution among SLS ILL staff. The search activity is primarily encountered for the location of a potential resource library. Expansion of this activity at SLS ILL also includes availability of items via CLSI searching. The obtain activity results when an attempt is made to retrieve the owned item from the shelf. If the item is found it is out-processed (i.e., circulation records are updated, packaging, and delivery, etc.), and the patron is satisfied.

The forward activity represents those procedures encountered when the resource library refers the request to the next resource library because they either did not own the requested item, or it was unavailable for circulation. In the case of the last resource library in the referral route, the forward activity would represent a cancelled request returned to the patron.

The primary purpose of verification may be either to clarify bibliographic information and/or identify potential resource libraries. Identification of potential resource libraries in this activity often utilizes union or library catalogs which are not restricted to SLS/ILLINET member locations only.

At the in-processing activity, we can categorize book requests as new requests and re-sent requests. New requests are initially received at SLS ILL and generated by the SLS member libraries. Re-sent requests have been previously received by SLS ILL. An attempt was made to satisfy the request but the potential resource library returned the request, usually because the item was unavailable and no reserve was requested for the item. Re-sent requests are thus processed by SLS ILL more than once and the time delay experienced with re-sent requests is due to the attempt to satisfy a request by accessing multiple resource libraries.

Processing book requests during the search activity includes three possible stages:

1. search of SLS Cluster data bases,
2. search of SLS Union Catalog,
3. search of CLSI Interconnect data bases.
4. search of MACs (microfilm catalogs).

A request which reaches the second, third, or fourth stage must be exhaustively processed at all previous stages.

In searching the SLS CLSI Cluster data bases and the CLSI Interconnect data bases, on-shelf location information is the primary goal. However, if a request is found at some location within the SLS CLSI Cluster or the SLS Union Catalog, the request is not searched any further regardless of the circulating status. Reserves are placed on circulating items. Any requests found in

the Cluster data bases which have multiple on-shelf locations and are located at one of the Headquarters Libraries, must be sent to the Headquarters Libraries first. In general, the SLS Union Catalog identifies holdings for those SLS member libraries which are not included in the Cluster data bases.

Requests which reach the third stage, the CLSI Interconnect, are either not found in any Cluster data base or SLS Union Catalog, or happen to be a non-circulating item (e.g., reference book). Again, at this stage, on-shelf locations are sought for each request. If the item is located at a resource library but found to be circulating, the request continues processing at the verification activity or search of the MACs. In the case of a request not found on-shelf at any Interconnect data base but found at ISL in circulation with no additional holds (i.e., previous reserves for the circulating item have not been placed), SLS ILL may TWX the request to ISL and request a reserve. (TWX refers to sending an ILL request notice via teletype.) A request TWX'd to ISL may either be satisfied by ISL and delivered to the SLS requesting library; it may be returned unfilled and thus qualify as a re-sent request; or ISL may refer the request to an R and R Center Library. Otherwise, requests not found in any Interconnect data base or found to be circulating at all possible locations are processed at the verification activity or search of the MACs.

The search activity for periodical article requests does not involve any computer readable data bases. The first data base consulted is generally the SLS Union List of Serials (SUL). The primary goal in searching SUL is to identify ownership by Oak Park. Other sources are consulted primarily to identify an R and R library (e.g., MACs). The decision to continue searching additional listings for locations other than the R and R libraries is made by the ILL librarian. In Table 2.3 we have identified the data bases consulted for periodical article requests during the time of this case study and the corresponding abbreviations. Requests for magazines which belong to newspapers, such as the New York Times Book Reviews, were classified as periodical requests. In the case of census microfilm requests, there is one primary source to consult for location, i.e., the Federal Archives catalog, abbreviated FCEN.

| | |
|---|---|
| SUL | SLS Union List of Serials |
| CPS | CPL Serials List |
| IMAC | ISL periodicals by title |
| UMAC | UOI periodicals by title in UMAC, or IU Newspapers on Microform |
| SMAC | SIU periodicals by title |
| LIB | SLS/LIBRAS, an Illinois regional listing |
| IHS | Illinois Historical Survey |
| ULS | Union List of Serials/New Serial Titles |
| ODB | Other Data Bases |

Table 2.3 Periodical Request Data Bases

The primary goal of the verification activity for books is to locate the item at one of the R and R Centers or Special Resource Libraries. By searching various national union catalogs, other library locations may be identified, in which case the request must conform with the National Interlibrary Loan Code of 1968. At this stage in the processing, requests may be cancelled because sufficient bibliographic information cannot be found, or because a title is out of print and without a possible resource library location. Requests which are fairly recent publications and cannot be located in the existing union catalogs are considered by the ILL librarian for purchase. Census microfilm requests are verified with specific reference tools for bibliographic and some demographic information, but location information is not the goal of verifying these requests. Journal article verification (i.e., bibliographic information regarding volume, issue, and pages) is attempted primarily for those requests which have been located at one of the R and R Libraries.

This general overview has summarized processing activities at SLS ILL. As noted earlier, considerably more detail appears in Appendix A. However, these details need not be pursued in order to gain a perspective for the results presented in this report. Thus, we will now describe the data collected for this case study.

Data Collection Methods

The purpose of this study was to collect data regarding interlibrary loan processing by SLS ILL and provide the System and network managers with a fairly accurate examination of the current state of SLS ILL as well as provide some predictions concerning the effects of possible changes in referral policies.

Data collection began on March 1, 1978 and data were collected for every request initially received by SLS ILL during the entire month. Since requests initiated in March continued to encounter processing after March 31, the actual data collection period extended to 5.5 months (through September 15, 1978). March was chosen because it was considered a typically busy month for SLS ILL, and we anticipated approximately 6000 requests. We decided not to sample the month's data and thus collected all requests initiated during March 1978.

As SLS ILL completed the processing of each request, the forms were mailed to the investigators. Prior to March 1978 it was decided that the current request forms used by SLS ILL for books, periodicals and census microfilms provided the necessary data for this study, with the exception of some date information. An additional date stamp was applied to these forms to indicate the reply dates of the resource libraries contacted by SLS ILL. Forms which we received were ready for data entry after preliminary screening for potential ambiguities and assignment of a subject classification, if necessary.

By April 1978, 7033 author/title requests had been initially received by SLS ILL during the month of March. By August 1, 1978 we had received a portion of those requests and asked SLS ILL to retrieve the remaining requests which were still in process at varying stages. Mainly, the pending requests were collected as an effort to complete the total picture of SLS ILL during one month's workload. By October 20, 1978, we had received a total of 6567 requests, 93% of all requests initiated in March 1978. The remaining 474 requests were assumed completed in terms of SLS ILL processing, e.g., SLS ILL either satisfied or cancelled the requests, and discussion with SLS ILL staff resulted in the assumption that these requests did not fall into the pending category.

Data Entry Procedures

The following data were entered for each request:

1. unique ID code, precoded on the request form
2. requesting library code
3. subject class (Dewey Decimal Classification)
4. whether or not the request was a rush
5. whether or not the request was a recheck
6. publication date
7. whether or not the request was received with a call number and location information
8. whether or not the request was received verified

9. whether or not SLS ILL engaged in the verification activity
10. whether or not additional information was found as a result of verification
11. date of request received at SLS ILL
12. whether or not the request was cancelled without routing
13. date sent from SLS ILL for request cancelled without routing.

Multiple data bases can be searched for each request. (See Table 2.4 for a complete list of data bases used at the time of this case study.) Data for each data base searched per request included the following:

14. code of data base searched
15. resource library code, located via the data base
16. status of the item at the potential resource library: owned-on shelf, owned-circulating, owned-rental/paperback-on shelf, owned-other.

For each resource library contacted per request the following data were collected:

17. code of resource library contacted for borrowing
18. date request left SLS ILL, or date request left a Center level library in the case of automatic referrals
19. whether or not a reserve was requested for an

item known to be circulating

20. whether or not a hold via CLSI was placed for an item known to be circulating
21. whether or not purchase procedures were initiated
22. whether or not SLS ILL requested an OCLC search for potential resource library locations
23. whether or not the OCLC search resulted in useful locations (i.e., contact was attempted)
24. whether or not the request was cancelled
25. whether or not the request was satisfied
26. date request or item was received at SLS ILL (returned by the resource library).

Most requests included the call number of the item on the request form. In some cases multiple locations for an item included different subject classifications. The class entered for this study corresponds with the resource library satisfying the request, or in the case of unfilled requests, the class entered corresponds with the first resource library in the route.

## SLS Cluster Data Bases

| | |
|---|---|
| OPS | Oak Park Data Base |
| PFS | Park Forest Data Base |
| EHS | Elmhurst Data Base |
| OLS | Oak Lawn Data Base |

## CLSI Interconnect Data Bases

| | |
|---|---|
| ISL | Illinois State Library Data Base |
| NILS | Northern Illinois Library System Data Base |
| NSLS | North Suburban Library System Data Base |
| RPLS | Rolling Prairie Library System Data Base |
| OCLC | Ohio College Library Center |

## Non-Computer Readable Data Bases

| | |
|---|---|
| SUC | SLS Union Catalog |
| BH | Book History |
| IMAC | ISL microfilm catalog |
| SMAC | SIU microfilm catalog |
| UMAC | UOI microfilm catalog |
| SUL | SLS Union List of Serials |
| FCEN | Federal Archives catalog |
| ULS | Union List of Serials/New Serial Titles |
| LIB | SLS/LIBRAS |
| IHS | Illinois Historical Survey |
| CPS | CPL Serials List |
| SHB | Shawnee Genealogical Bibliography |
| LCL | Library of Congress, locations |
| ODB | Other data bases such as NUC, Mansell, etc. used for location information |

Table 2.4 Data Bases Searched by SLS ILL

Requests which required an assigned subject classification were handled by the research assistant responsible for data entry. Class assignment was based on the 1000 divisions of the Dewey Decimal Classification. Author, title and publisher information were utilized in assigning appropriate classes. Any requests classified with an "F", "M" or "SF" were assigned a code for fiction, and any requests classified with a "B" were assigned a code for biography. Requests for newspaper articles (as well as newspapers on microfilm) were assigned the Dewey class 070, which is also used to classify items about journalism. Requests for all census microfilm were assigned the 929 Dewey class. In the case of photocopies of journal articles, the class assignment was based on the title of the larger work.

In addition to subject class and type of request, publication date was also entered as a potentially interesting way to partition requests. When available, the last 2 digits of the publication date were entered. Any requests with dates prior to 1901 were coded as one group.

Data were coded to indicate whether or not a request was a re-check. This type of request may result when SLS ILL staff discover a change in bibliographic information which requires that search procedures begin again. A request may also qualify as a re-check because re-searching of data bases occurred even though the verification activity did not result in changed bibliographic information. For example, the request may indicate a substitute edition is acceptable if the preferred edition is

not available. Locating the requested item may therefore require a re-searching of data bases. It is thus expected that re-check requests encounter longer processing times at SLS ILL than non-re-check requests. From this data we should be able to determine how often re-check requests are encountered and whether or not the average processing time of re-check requests is longer than requests with the correct bibliographic information.

Re-sent requests are another category of requests related to re-entering the search activity. Re-sent requests are sometimes referred to as direct requests because SLS ILL will decide the next referral in the route only after the request has been returned to SLS ILL by the current resource library. All requests routed by SLS ILL to its member libraries are handled directly by SLS ILL. Upon receipt of a returned request to SLS ILL we assume a re-search of the appropriate CLSI data bases is encountered before sending the request to the next potential resource library in the route. This policy of re-searching the CLSI data bases insures obtaining the most current status of items with respect to availability.

In some cases, SLS ILL might receive a request with call number and location information from the requesting library. This data was entered only if SLS ILL used this information which would enable them to bypass normal search procedures (i.e., the sequence of data base searching described in an earlier section).

For data entry purposes, on-shelf status was assumed for all requests found in a non-computer readable data base. Verification was considered useful if additional information was found which resulted in either a change in bibliographic information (i.e., a re-check request), or additional library locations of which at least one was contacted.

Date information was collected primarily to determine the average processing time of SLS ILL and the average waiting time experienced by the patron.

In Table 2.5 we have listed by name and code all 61 resource libraries which were contacted or known to have owned an item during the course of this case study.

| | | | |
|---|---|---|---|
| AMS | Alsip | MWS | Maywood |
| BIS | Blue Island | MVC | Moraine Valley Community College |
| BVS | Bridgeview | | |
| COS | Country Club Hills | NSL | North Suburban Library System |
| CPL | Chicago Public Library | | |
| CTC | Concordia Teachers College | NIL | Northern Illinois Library System |
| CTS | Crete | | |
| DOS | Dolton | NLS | Northlake |
| DGS | Downers Grove | NWL | Northwestern |
| ESS | Eisenhower | OFA | Oak Forest Hospital |
| EHS | Elmhurst | OLS | Oak Lawn |
| ELC | Elmhurst College | OPS | Oak Park |
| EPS | Elmwood Park | OSL | Out of State Libraries |
| EVS | Evergreen Park | OTL | Other Illinois Libraries |
| ARV | Federal Archives | PFS | Park Forest |
| FCS | Flagg Creek | RFS | River Forest |
| FPS | Forest Park | RSS | Riverside Public Library |
| FRS | Frankfort | RPL | Rolling Prairie Library System |
| GWS | Glenwood | | |
| GSU | Governors State University | ROC | Rosary College |
| HAS | Harvey | SPS | Schiller Park |
| HSS | Hillside | SHW | Shawnee Library System |
| HDS | Hinsdale | SBS | SLS Bookmobile |
| HWS | Homewood Public Library | SIS | SLS Information Service |
| IBC | Illinois Benedictine College | SIU | Southern Illinois University |
| IHL | Illinois Historical Society Library | SLS | Suburban Library System |
| | | SAS | Summit-Argo |
| ISL | Illinois State Library | TRC | Triton College |
| JCL | John Crerar | UCL | University of Chicago |
| LGS | LaGrange Public Library | UOI | University of Illinois |
| LPS | LaGrange Park Library District | UIM | University of Illinois, Medical Center |
| LSS | Lansing | WMS | Westmont Public Library |
| LDS | Lisle | WRS | Woodridge Public Library |

Table 2.5 Resource Libraries and Codes

Resulting Data Base

Requests were delivered by van to the UOI Research and Reference Center and subsequently delivered to the investigators from March-October 1978. Initially, the requests were sorted for identification of ambiguous data as well as those requests which were without any call number. Requests with call number and straightforward data were entered without further delay. The remaining requests were entered after data interpretation. Problems were clarified and subject classes assigned. SLS ILL was consulted for advice in interpreting the ambiguous data.

Based on the statistics tallied by SLS ILL, they received 6366 requests for books, 440 requests for periodicals, and 277 requests for census microfilm during the month of March 1978. Thus, a total of 7033 unique requests were initially received by SLS during March. By August 15, 1978, we had received 90% of all requests and asked SLS ILL to retrieve the pending requests from their various files in different stages of processing. Pending requests received resulted in 106 book requests, 0 periodical requests, and 30 census microfilm requests. The resulting data base consists of 6567 unique requests initiated during March 1978: 5920 book requests, 425 periodical requests, and 222 census microfilm requests.

We will present some purely empirical results (i.e., measurements rather than predictions) that might be of interest to SLS ILL before we proceed with the description of data necessary for estimating the model parameters. The subject area

of requests was defined by the Dewey classification. Since many classes were infrequently represented we had to aggregate groups of subject classes for convenience in analyzing requests. Thus, request subject categories are represented by the 18 classes described in Table 2.6, which includes the corresponding Dewey classes. Throughout this report subject analysis will refer to these 18 classes by the labels listed in Table 2.6.

| ABBREVIATION | DEWEY DECIMAL CLASS |
|---|---|
| Fiction<br>813+823 | 813 (American Fiction),<br>823 (English Fiction) F,Y,J,P |
| General<br>001-099 | 001-099 (Generalities) |
| Philosophy<br>100-299 | 100-129 (Philosophy);<br>140-149 (Specific Philosophical Viewpoints); 160-199 (Logic, Ethics, Ancient Philosophy, Modern Western Philosophy); 200-299 (Religion) |
| Psychology<br>130-159 | 130-139 (Parapsychology);<br>150-159 (Psychology) |
| Social Sci<br>300-369 | 300-309 (Social Sciences);<br>360-369 (Social Pathology, Social Services Associations) |
| Poltcl Sci<br>320-659 | 320-349 (Political Science, Economics, Law); 350-359 (Public Administration, Executive Branch, Military Art and Science); 380-389 (Commerce, Communications, Transportation); 650-659 (Managerial Services) |
| Education<br>370-379 | 370-379 (Education) |
| Language<br>400-499 | 400-499 (Language) |
| Sci-Eng<br>310-699 | 310-319 (Statistics);<br>500-509 (Pure Sciences)<br>510-519 (Mathematics);<br>520-539 (Astronomy,Physics);<br>540-549 (Chemistry); 550-559 (Earth Sciences); 600-609 (Technology); 620-629 (Engineering);<br>660-699 (Chemical Technology, Manufactures, Buildings) |

Table 2.6 Aggregated Request Classes
(continued)

| ABBREVIATION | DEWEY DECIMAL CLASS |
|---|---|
| Life Sci 560-639 | 560-579 (Paleontology, Life Sciences); 580-589 (Botanical Sciences); 590-599 (Zoological Sciences); 630-639 (Agriculture) |
| Medicl Sci 610-619 | 610-619 (Medical Sciences) |
| Home Econ 390-649 | 390-399 (Customs, Folklore); 640-649 (Home Economics) |
| Arts 700-779 | 700-779 (Fine and Decorative Arts) |
| Music 780-789 | 780-789 (Music) |
| Recreation 790-799 | 790-799 (Recreational and Performing Arts) |
| Literature 800-899 | 800-812, 814-822, 824-829 (American and English Literature, Rhetoric excluding Fiction); 830-839 (German Literature); 840-879 (Romance Literature); 880-899 (Greek and Other Literature) |
| History 900-999 | 900-919 (History, Geography, Travels); 930-939 (Ancient History); 940-949 (Modern Europe); 950-959 (Modern Asia); 960-969 (Modern Africa); 970-979 (North America); 980-989 (South America); 990-999 (General History of Other Areas) |
| Biography 920-929 | 920-929 (Biography, Genealogy) |

Table 2.6 Aggregated Request Classes

From Table 2.7, we can find the probability of satisfying a request in a given subject category. This probability calculation is based on the number of requests initiated in each class during March 1978. From this table we find that 90% of the requests received by SLS ILL are satisfied. The lowest probability of satisfaction (80%) applies to biography, and the smallest number of requests generated in any category applies to language with a total of 35 requests.

| CLASS | | PROBABILITY SATISFIED | PROBABILITY UNSATISFIED | NUMBER OF REQUESTS |
|---|---|---|---|---|
| FICTION | (813+823) | 0.92 | 0.08 | 1373 |
| GENERAL | (001-099) | 0.87 | 0.13 | 235 |
| PHILOSOPHY | (100-299) | 0.87 | 0.13 | 88 |
| PSYCHOLOGY | (130-159) | 0.92 | 0.08 | 333 |
| SOCIAL SCI | (300-369) | 0.91 | 0.09 | 371 |
| POLTCL SCI | (320-659) | 0.88 | 0.12 | 517 |
| EDUCATION | (370-379) | 0.92 | 0.08 | 143 |
| LANGUAGE | (400-499) | 0.89 | 0.11 | 35 |
| SCI-ENG | (310-699) | 0.86 | 0.14 | 360 |
| LIFE SCI | (560-639) | 0.90 | 0.10 | 172 |
| MEDICL SCI | (610-619) | 0.86 | 0.14 | 586 |
| HOME ECON | (390-649) | 0.95 | 0.05 | 215 |
| ARTS | (700-779) | 0.92 | 0.08 | 352 |
| MUSIC | (780-789) | 0.96 | 0.04 | 104 |
| RECREATION | (790-799) | 0.96 | 0.04 | 240 |
| LITERATURE | (800-899) | 0.87 | 0.13 | 250 |
| HISTORY | (900-999) | 0.93 | 0.07 | 449 |
| BIOGRAPHY | (920-929) | 0.80 | 0.20 | 547 |
| ACROSS CLASSES | | 0.90 | 0.10 | 6567 |

Table 2.7 Probability of Satisfaction
Empirical Data

We found that of the requests with complete date information, SLS ILL initiated the purchase of 303 items which were originally requested in March 1978. The average waiting time to complete the processing of purchased items (i.e., the

time between the initial date of the request received at SLS ILL to the final date of sending the item to the requesting library) was found to be approximately 67 days, or slightly more than two months. Table 2.8 provides the waiting time to process purchased requests, including the average and standard deviation for the waiting time in each subject category. Fiction requests account for the largest number of purchases in a single category.

| CLASS | | WAITING TIME AVERAGE | STD. DEV. | NUMBER OF REQUESTS |
|---|---|---|---|---|
| FICTION | (813+823) | 64.64 | 32.31 | 65 |
| GENERAL | (001-099) | 70.50 | 44.56 | 6 |
| PHILOSOPHY | (100-299) | 66.29 | 33.75 | 19 |
| PSYCHOLOGY | (130-159) | 50.17 | 22.49 | 15 |
| SOCIAL SCI | (300-369) | 78.50 | 45.80 | 13 |
| POLTCL SCI | (320-659) | 59.72 | 38.34 | 18 |
| EDUCATION | (370-379) | 58.28 | 26.36 | 9 |
| LANGUAGE | (400-499) | 28.50 | 0.00 | 1 |
| SCI-ENG | (310-699) | 78.11 | 41.73 | 28 |
| LIFE SCI | (560-639) | 69.63 | 29.52 | 8 |
| MEDICL SCI | (610-619) | 59.56 | 34.73 | 16 |
| HOME ECON | (390-649) | 57.63 | 34.45 | 15 |
| ARTS | (700-779) | 77.94 | 33.76 | 27 |
| MUSIC | (780-789) | 68.07 | 27.37 | 7 |
| RECREATION | (790-799) | 75.06 | 38.86 | 16 |
| LITERATURE | (800-899) | 65.50 | 56.68 | 7 |
| HISTORY | (900-999) | 78.57 | 41.06 | 15 |
| BIOGRAPHY | (920-929) | 60.33 | 34.40 | 18 |
| ACROSS CLASSES | | 67.17 | 35.94 | 303 |

Table 2.8 Purchased Requests Waiting Time

The waiting time for re-check requests was calculated for satisfied and unsatisfied requests. There were 262 re-check requests that had complete date information and were satisfied. These requests encountered an average of 41.66 days of waiting time with a standard deviation of 37.75 days. There were only 12

re-check requests that were unsatisfied and had complete date information. We found that these requests averaged 68.08 days of waiting time with a standard deviation of 50.77 days.

Additional waiting time statistics were calculated for cancelled requests after routing as well as requests cancelled without routing. Based on 183 cancelled requests with complete date information we find that the average waiting time is 69.04 days with a standard deviation of 50.92 days. We find that 273 requests were cancelled without routing and included complete date information. The average waiting time for these requests is 47.47 days with a standard deviation of 54.22 days.

Some other data that might interest SLS ILL includes requests sent to ISL for OCLC searching, and the results of SLS ILL's verification activity. Of the 79 requests sent to ISL for OCLC searching, 27 (34%) resulted in useful locations which were defined as resource libraries contacted after their identification was found through OCLC.

SLS ILL encountered the verification activity for 1641 requests, of which 1340 (82%) were eventually satisfied. Based on the 1641 requests which encountered verification at SLS ILL, 249 (15%) resulted in additional information, of which 235 (95%) were satisfied. These last few statistics suggest that the verification activity at SLS ILL is quite successful, resulting in the satisfaction of 82% of the requests which encounter verification. However, one might question the extent to which verification by SLS ILL is actually necessary. We found that

only 15% of these requests resulted in changes in author or title, or identification of holding libraries, and yet a fairly large percentage of all requests encountering verification were satisfied. One might consider evaluating this activity in terms of successful outcome (i.e., finding additional information), whether or not the request is satisfied, and comparison of the SLS ILL processing time for requests with and without the verification activity. We address SLS ILL processing time in Chapter Three under "Model of Intralibrary Processing."

The usefulness of various data bases used by SLS ILL can be measured by looking at some relevant probabilities of success. For example, we found that SLS ILL can expect to find at least one resource library location for 88% of the requests that are searched in the data bases listed in Table 2.4.

The optimal order of accessing data bases can be identified by the decreasing order of probabilities of ownership given a search of a data base. The SLS Cluster data bases appear to fall into the order currently used by SLS. However, the probabilities associated with the MACs are much higher than SUC and the Interconnect data bases. We can probably hypothesize that there is considerable overlap among System Library collections because the data indicate that if a request is not found in the SLS Cluster libraries the probability that it will be found in other System data bases becomes very low. We found that the highest probability associated with the Interconnect data bases is ISL, a non-System Library collection.

Since SLS has established a policy of first exhausting all member libraries before going outside the System, we would make an exception in the case of SUC which is normally searched after the SLS Cluster data bases. Based on the probabilities we found, we suggest searching the MACs, after SUC with the following sequence before searching the Interconnect data bases:

1. UMAC
2. IMAC
3. BH
4. SMAC
5. ISL data base
6. NSL data base
7. NIL data base
8. RPL data base

We also looked at the usefulness of searching the CLSI data bases, i.e. the SLS Cluster and Interconnects. One measure of the usefulness of an online circulation system is how often one can expect to find on-shelf locations for requests owned by resource libraries identified by the system. From Table 2.9, we find that EPS has the overall highest probability of on-shelf locations when compared to other SLS Cluster libraries.[3] RPL has

[3] We have disregarded the probabilities found for LSS and FRS, since we were previously informed that neither library indicates circulation status. On-shelf status only is indicated for owned items. However, our data indicate this is not always the case, since SLS ILL can change the circulation status when handling inter-System borrowing.

the highest probability of on-shelf locations for both Cluster and Interconnect libraries; however, this probability is based on a total of 14 requests found to be owned by RPL. All other probabilities of on-shelf locations are based on over 100 requests owned by the resource library with the following exceptions: NIL, NSL, and LSS. (Note that the total number owned does not represent unique requests, because more than one library may own the same item.) Given a search of any CLSI data base, SLS ILL can expect to find on-shelf locations 57% of the time.

Another statistic of interest with respect to CLSI searching is the probability of availability given a request is found to be on-shelf and received by a resource library. From Table 2.10 we find that SLS can expect an overall .76 probability of availability for requests sent to any resource library with on-shelf status indicated in the CLSI data bases. The highest probability of availability occurs at ESS, HAS, and SLS. The total number of requests found on-shelf at each resource library is also indicated in Table 2.10. It is interesting to note that OPS has a relatively large number of on-shelf locations but relatively low probability of availability.

We also analyzed the requests to obtain processing time and waiting time statistics. Processing time is defined as the duration of intralibrary processing from initial date of receipt at SLS ILL to the date when the request first leaves SLS ILL. Based on the data collected for this study, we found that the

initial processing time at SLS ILL accounts for an average of 6.87 days (standard deviation = 18.14 days, number of requests with appropriate dates = 6077). Processing time data is also available for the re-routing process at SLS ILL. We found that an average of 5.12 days are required for SLS ILL to re-route a request (standard deviation = 8.16, number of requests with appropriate dates = 950).

| Library | Probability | Number Owned |
|---|---|---|
| LSS | .97 | 97 |
| RPL | .86 | 14 |
| ISL | .80 | 252 |
| NSL | .76 | 96 |
| NIL | .75 | 63 |
| EPS | .72 | 766 |
| PFS | .65 | 1509 |
| ESS | .64 | 750 |
| FRS | .61 | 177 |
| HAS | .59 | 1304 |
| OPS | .58 | 2301 |
| DOS | .54 | 1107 |
| EHS | .52 | 734 |
| NLS | .52 | 344 |
| DGS | .49 | 513 |
| SLS | .42 | 765 |
| AMS | .35 | 342 |
| OLS | .33 | 627 |
| Overall | .57 | 11761 |

Table 2.9 Probability of Finding On-shelf Locations Given a Search of the Data Base

| Library | Probability | Number On-Shelf |
|---|---|---|
| ESS | .98 | 139 |
| HAS | .98 | 253 |
| SLS | .98 | 312 |
| FRS | .94 | 16 |
| EPS | .91 | 98 |
| ISL | .91 | 199 |
| NLS | .67 | 70 |
| DOS | .83 | 150 |
| PFS | .81 | 593 |
| LSS | .80 | 45 |
| AMS | .79 | 62 |
| OLS | .76 | 133 |
| EHS | .68 | 257 |
| NSL | .67 | 70 |
| NIL | .64 | 47 |
| OPS | .61 | 1175 |
| DGS | .56 | 99 |
| RPL | .33 | 12 |
| Overall | .76 | 3737 |

Table 2.10 Probability of Availability Given On-Shelf Locations and Resource Library Contacted

Waiting time statistics were collected for resource libraries processing requests during the course of this study. The date stamp employed by SLS ILL to record processing by resource libraries includes delivery time as well as the resource

library internal processing time. Waiting time is defined as the time interval from the date a request leaves SLS ILL for processing by a particular resource library to the date a request or item is received at SLS ILL from the resource library.

Network waiting time was analyzed by classifying requests as reserve/hold requests, purchase requests, and others (i.e., those which encountered neither reserve/hold procedures nor purchase procedures). The average request processed by the SLS network will encounter a waiting time of 14.25 days at any one resource library (standard deviation = 22.13, N=6942). An average of 22.75 days is required for any one resource library to process a reserve/hold item (standard deviation = 29.47, N = 2004).

Satisfied requests which include the non-reserve, non-purchase items, required an average of 7.72 days at any one resource library (standard deviation = 10.50, N = 3425). Processing time at SLS ILL (which does not include delivery time) resulted in an average of 1.41 days to satisfy non-reserve, non-purchase items (standard deviation = 7.48, N = 347). Among the SLS member libraries, EPS[1] required the longest average waiting time to satisfy non-reserve, non-purchase requests: 16.17 days (standard deviation = 21.32, N = 107).

[1]March 1978 was the first month of CLSI participation for EPS and the relatively long processing time is probably a reflection of contending with the new procedures and demand generated by CLSI.

The majority of purchased requests were purchased by SLS ILL. Satisfied requests purchased by SLS ILL required an average of 46.15 days (standard deviation = 29.90, N = 280); and unsatisfied requests required an average of 100.32 days (standard deviation = 42.54, N = 17).

Of the 136 pending requests only 7 requests had not yet been forwarded to a resource library. The average number of resource libraries contacted preceding the pending library was found to be 1.35 (standard deviation = 1.02, N = 174). The average turnaround time for these requests was determined by the duration of time from initial receipt of the request to the last date the request left SLS ILL. The average waiting time was 81.26 days (standard deviation = 62.17, N = 174).

We have thus far described the study plan of SLS ILL activities and some of the empirical data. In the following chapter we will describe general characteristics of the model, how the necessary inputs to the model are formulated, and develop a model of the specific internal procedures encountered by requests processed by SLS ILL.

# Chapter Three

# FORMATION OF MODEL PARAMETERS

## General Characteristics of the Model

The main purpose of applying the library network model to any case study is to predict the effects of alternative routing policies on network performance measures. Managers of library networks need forecasts of network performance to guide their decisions in changing or updating current policies. The model provides managers with one component of the decision making process, namely, quantitative predictions of network performance measures.

In evaluating library networks one usually considers the type of service provided by networks. In general, library network services consist of an exchange of documents or messages. Requesting libraries (or borrowing libraries) request services provided by resource libraries (or loaning/lending libraries). The primary purpose of resource sharing networks is the improvement of service to library patrons. Improvement of service might be defined as increasing the probability of successfully providing the desired service while also decreasing the patron's waiting time as well as maintaining current costs.

Application of the library network model has focused on interlibrary loan networks. Improving network services requires some definition of network performance which enables one to evaluate the service. We have defined the following quantitative

measures of network performance:

1. probability of satisfying a request,
2. average waiting time to satisfy a request,
3. average cost to satisfy a request.

Managers of library networks would like to choose network operating policies so as to maximize the probability of satisfying requests while also minimizing the average waiting time and cost to satisfy a request. These are conflicting objectives and it is obvious that a tradeoff develops between desirable values of probability of satisfaction and waiting time and one's willingness to expend costs. Discussion of specific tradeoffs for SLS will be addressed in Chapter Four. The remainder of this section will describe the network activities represented within the model.

The outputs provided by the library network model are the predictions of network performance measures. Inputs are required which describe the current state of the network. Based on the data collected for the case study, parameters necessary to the model are formulated. Formation of these parameters are discussed in the following section, but it is sufficient at this point to say only that the parameters describe the basic quantitative characteristics of the library network. Once these basic parameters have been formulated, the manager can define alternative routing policies and evaluate their effects based on the predictions of network performance measures.

We have thus far described three major components of a library network:

1. resource libraries
2. requesting libraries
3. exchange of documents and messages.

Measures of network performance enable us to evaluate the network with respect to the type of service provided. A fourth component to include in the above list is the routing policies of a network. Routing policies refer to the protocols which define the referral route a request encounters as it seeks satisfaction in the network. More specifically, the referral route identifies the order of particular resource libraries which process the request. The outcome resulting after each resource library processing can be described as one of the alternatives:

1. item owned, available, and patron satisfied
2. item owned, unavailable, and patron unsatisfied
3. item owned, unavailable, and referred
4. item not owned, patron unsatisfied
5. item not owned, referred.

Referral, of course, depends on the network's routing policy. We refer to this type of activity as an interlibrary network. In Figure 3.1, we have illustrated the referral routes of request classes within a hypothetical network of 4 resource libraries. For simplification we have illustrated how 3 request classes (e.g., books, periodicals, and census) might be referred

or processed in a 4 member library network. As illustrated, the sequence of particular resource libraries varies depending on the request class and performance measures experienced by the network. For example, in Figure 3.1, we find that books experience the following referral route: A-B-C-D; while periodicals encounter the following route: B-D-A; and census requests encounter the route with the smallest number of resource libraries: A-C. Further discussion of how to specify alternative routing policies for the model is provided in Chapter Four.

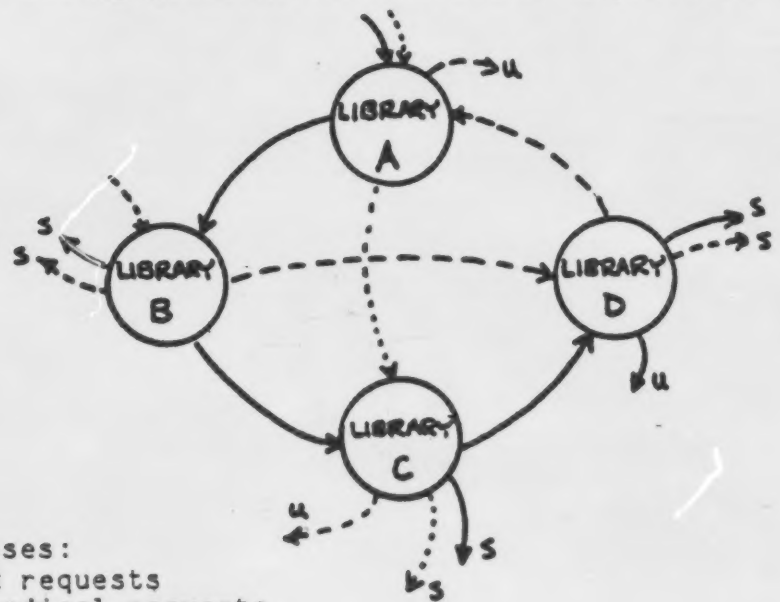
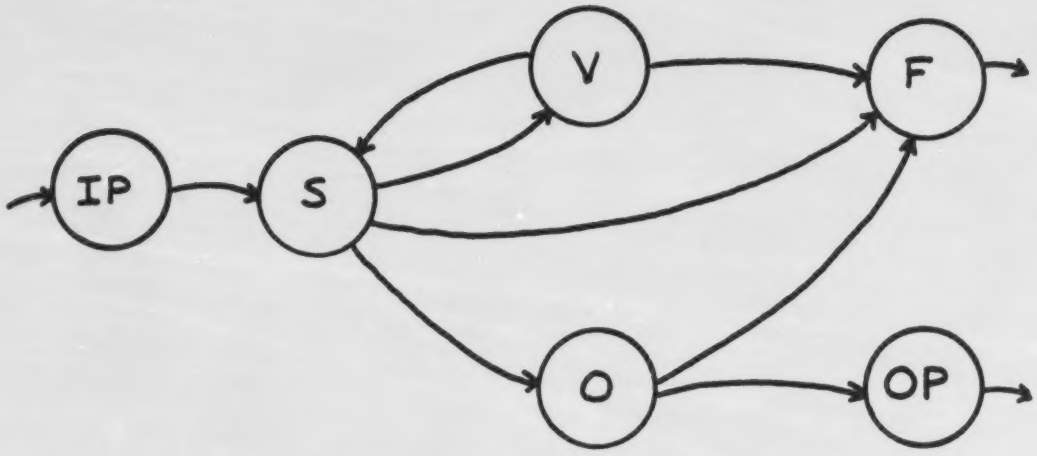



Figure 3.1 Interlibrary Processing

In addition to representing the processing of requests among libraries, the library network model includes a representation of the processing of requests within libraries. Intralibrary processing is represented as a series of nodes or activities within each of the resource libraries (e.g., A,B,C,D) depicted in Figure 3.1. A specific example of this sub-network of activities, intralibrary processing, is illustrated in Figure 3.2. This example does not describe the internal processing at SLS but has served as a generalization of some significant intralibrary processes encountered in our previous case studies.

The arcs or lines between nodes represent the paths encountered by requests as they are processed within the resource library. Note that alternative outcomes are possible when exiting from each node. For example, a resource library may not be able to determine if they own a particular item and thus, they engage in verification procedures. If additional information results from that activity, a re-search of the catalog may result in location of the requested item. The item may then be found on the shelf available for circulation, and processed for receipt by the patron. This sequence of intralibrary processing can be described by the following nodes: IP-S-V-S-O-OP. Analysis of the significant processes encountered within SLS ILL is provided in a later section of this chapter.




IP in-processing of request
S search of catalog
O obtain item from shelf
OP out-processing of desired item, patron satisfied
V verification
F forwarding of unsatisfied request

Figure 3.2 Tentative Model of Intralibrary Processing

In traditional, i.e., non-computer aided, interlibrary loan networks we can clearly separate the two types of processing described in Figures 3.1 and 3.2. The primary goal of intralibrary processing is to determine location of the requested item within the processing library. Additional resource library locations are usually sought via union catalogs in printed form, for example. In this case, determination of the availability of requested items is usually not considered an achievable goal of the activity encountered within the resource library processing the request. However, with the use of CLSI, SLS ILL encounters a "search" activity which enables them to function as a requesting library and resource library simultaneously. The search node activity for SLS ILL includes the inter library processing defined in Figure 3.1, because ownership and availability information are obtained for potential resource libraries which may or may not

actually receive the request. A model specific to SLS ILL internal procedures will be formulated and discussed in a later section of this chapter. In the following section we will discuss estimation of model parameters based on data coded for this case study.

Model Parameters

In summary, the model's predictions of network performance measures are expressed as the 1) probability of success, 2) average waiting time, and 3) average cost of satisfying a request. Predictions of these performance measures require certain parameters to be estimated based on the raw data described in Chapter Two. Parameters necessary to the model include:

1. average demand per unit time (e.g., per day) generated by each requesting library in each request class,
2. models of intralibrary processing within each resource library, including definition of processes, probabilities of transitions among processes, and average processing times and costs for each process,
3. average delivery times between each resource library and each requesting library for each class.

In this case study, reimbursement costs or the costs for each process are not considered. Also, the delivery time estimates are not separately calculated because the time data for

resource libraries includes delivery time plus resource library processing time. Within this chapter, we will discuss how the data base described in Chapter Two was used to develop estimates of the parameters necessary to the model.

Demands

Demands are characterized by the average number of requests generated per day by each requesting library in each request class. We have already identified the requesting libraries in Table 2.1, and the request classes were identified in Table 2.6. The demand parameters in Table 3.1 resulted. These estimates were calculated by dividing the number of requests generated in each requesting library-request class combination by 23, the number of working days during March 1978. As an example of how to read Table 3.1 we find that ADS (Acorn Library District) generates an average of 1.30 fiction requests per day to SLS ILL. Overall demand, aggregated across all classes and requesting libraries, results in an average daily demand at SLS ILL of 285.52 requests.

While it is not essential to our analyses here, it is also interesting to look at publication dates of the items requested. Thus, in Appendix C, we have presented this categorization of demands. In the following section we will describe how estimates are obtained for SLS ILL intralibrary processing.

| | REQUESTING LIBRARY | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | ADS | AMS | BPS | BWS | BKS | BYS | BIS | BVS | BRS | BFS | CCS | CHS | CRS | CLS | COS |
| FICTION 813+823 | 1.30 | 0.61 | 0.13 | 0.52 | 0.35 | 0.30 | 1.09 | 2.35 | 0.17 | 0.96 | 1.13 | 0.61 | 0.61 | 0.61 | 1.61 |
| GENERAL 001-099 | 0.09 | 0.35 | 0.00 | 0.00 | 0.70 | 0.04 | 0.00 | 0.04 | 0.00 | 0.17 | 0.26 | 0.43 | 0.00 | 0.04 | 0.13 |
| PHILOSOPHY 100-299 | 0.09 | 0.04 | 0.04 | 0.04 | 0.09 | 0.09 | 0.26 | 0.26 | 0.00 | 0.09 | 0.13 | 0.17 | 0.26 | 0.17 | 0.13 |
| PSYCHOLOGY 130-159 | 0.48 | 0.13 | 0.22 | 0.22 | 0.09 | 0.04 | 0.04 | 0.13 | 0.22 | 0.22 | 0.39 | 0.48 | 0.04 | 0.30 | 0.43 |
| SOCIAL SCI 300-369 | 0.39 | 0.30 | 0.26 | 0.17 | 0.13 | 0.00 | 0.22 | 0.22 | 0.13 | 0.22 | 0.13 | 0.35 | 0.52 | 0.26 | 0.26 |
| POLTCL SCI 320-659 | 0.39 | 0.04 | 0.00 | 0.17 | 0.04 | 0.22 | 0.09 | 0.65 | 0.35 | 0.17 | 0.22 | 0.65 | 0.22 | 0.61 | 0.61 |
| EDUCATION 370-379 | 0.17 | 0.09 | 0.04 | 0.04 | 0.09 | 0.04 | 0.00 | 0.09 | 0.00 | 0.04 | 0.09 | 0.13 | 0.04 | 0.17 | 0.26 |
| LANGUAGE 400-499 | 0.04 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SCI-ENG 310-699 | 0.09 | 0.48 | 0.09 | 0.09 | 0.09 | 0.09 | 0.04 | 0.26 | 0.17 | 0.43 | 1.17 | 0.17 | 0.09 | 0.26 | 0.09 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | CWS | CTS | DOS | DGS | ECS | ESS | EHS | EPS | EVS | FCS | FMS | FPS | FRS | GWS | GHS |
| FICTION 813+823 | 0.61 | 0.65 | 0.57 | 0.30 | 0.00 | 0.78 | 1.13 | 1.26 | 1.39 | 2.61 | 1.04 | 0.17 | 0.35 | 1.04 | 1.35 |
| GENERAL 001-099 | 0.00 | 0.00 | 1.04 | 0.22 | 0.00 | 0.26 | 0.17 | 0.04 | 0.04 | 0.04 | 0.13 | 0.04 | 0.30 | 0.00 | 0.22 |
| PHILOSOPHY 100-299 | 0.00 | 0.04 | 0.39 | 0.26 | 0.00 | 0.13 | 0.61 | 0.30 | 0.04 | 0.09 | 0.30 | 0.22 | 0.04 | 0.04 | 0.13 |
| PSYCHOLOGY 130-159 | 0.09 | 0.13 | 0.17 | 0.43 | 0.00 | 0.13 | 0.26 | 0.22 | 0.17 | 0.39 | 0.48 | 0.13 | 0.26 | 0.13 | 0.52 |
| SOCIAL SCI 300-369 | 0.00 | 0.09 | 0.43 | 0.09 | 0.00 | 0.09 | 0.78 | 0.30 | 0.26 | 0.35 | 0.22 | 0.09 | 0.17 | 0.13 | 0.30 |
| POLTCL SCI 320-659 | 0.00 | 0.09 | 0.70 | 0.87 | 0.09 | 0.17 | 0.48 | 0.39 | 0.39 | 0.65 | 0.43 | 0.04 | 0.26 | 0.09 | 0.13 |
| EDUCATION 370-379 | 0.00 | 0.04 | 0.35 | 0.09 | 0.00 | 0.30 | 0.09 | 0.04 | 0.04 | 0.09 | 0.04 | 0.17 | 0.09 | 0.00 | 0.17 |
| LANGUAGE 400-499 | 0.00 | 0.04 | 0.00 | 0.04 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 |
| SCI-ENG 310-699 | 0.22 | 0.00 | 0.48 | 0.35 | 0.00 | 0.22 | 0.61 | 0.30 | 0.17 | 0.17 | 0.13 | 0.13 | 0.04 | 0.13 | 0.39 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | HAS | HSS | HDS | HKS | HTS | HWS | LGS | LPS | LSS | LDS | LYS | MCS | MKS | MTS | MWS |
| FICTION 813+823 | 0.09 | 0.30 | 0.57 | 0.00 | 0.74 | 0.91 | 1.13 | 2.87 | 0.22 | 1.17 | 0.70 | 0.00 | 0.74 | 0.61 | 0.57 |
| GENERAL 001-099 | 0.30 | 0.09 | 0.04 | 0.00 | 0.00 | 0.26 | 0.22 | 0.22 | 0.26 | 0.04 | 0.26 | 0.00 | 0.13 | 0.09 | 0.13 |
| PHILOSOPHY 100-299 | 0.17 | 0.04 | 0.09 | 0.00 | 0.04 | 0.04 | 0.43 | 0.17 | 0.09 | 0.30 | 0.04 | 0.00 | 0.22 | 0.17 | 0.30 |
| PSYCHOLOGY 130-159 | 0.13 | 0.00 | 0.22 | 0.00 | 0.00 | 0.26 | 0.48 | 0.17 | 0.35 | 0.35 | 0.00 | 0.00 | 0.09 | 0.09 | 0.13 |
| SOCIAL SCI 300-369 | 0.04 | 0.00 | 0.09 | 0.00 | 0.09 | 0.17 | 0.17 | 0.52 | 0.35 | 0.35 | 0.00 | 0.00 | 0.04 | 0.13 | 0.17 |
| POLTCL SCI 320-659 | 0.00 | 0.22 | 0.35 | 0.00 | 0.00 | 0.26 | 0.26 | 0.30 | 0.17 | 0.17 | 0.09 | 0.00 | 0.43 | 0.17 | 0.30 |
| EDUCATION 370-379 | 0.26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 0.09 | 0.00 | 0.09 | 0.04 | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 |
| LANGUAGE 400-499 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| SCI-ENG 310-699 | 0.22 | 0.00 | 0.13 | 0.00 | 0.09 | 0.17 | 0.22 | 0.22 | 0.17 | 0.26 | 0.26 | 0.00 | 0.04 | 0.00 | 0.35 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | MPS | MDS | NLS | OLS | OPS | ORS | PHS | PFS | PSS | ROS | RFS | RGS | RDS | RSS | RPS |
| FICTION 813+823 | 0.52 | 1.57 | 0.61 | 0.22 | 1.22 | 0.96 | 0.52 | 0.78 | 0.22 | 0.00 | 1.30 | 0.61 | 1.17 | 0.65 | 0.17 |
| GENERAL 001-099 | 0.00 | 0.22 | 0.00 | 0.09 | 0.17 | 0.09 | 0.17 | 0.39 | 0.04 | 0.00 | 0.09 | 0.13 | 0.09 | 0.17 | 0.04 |
| PHILOSOPHY 100-299 | 0.09 | 0.13 | 0.09 | 0.13 | 0.43 | 0.17 | 0.04 | 0.26 | 0.09 | 0.00 | 0.26 | 0.22 | 0.17 | 0.00 | 0.09 |
| PSYCHOLOGY 130-159 | 0.00 | 0.04 | 0.13 | 0.09 | 0.52 | 0.09 | 0.00 | 0.30 | 0.04 | 0.00 | 0.26 | 0.17 | 0.26 | 0.13 | 0.30 |
| SOCIAL SCI 300-369 | 0.00 | 0.22 | 0.09 | 0.04 | 0.65 | 0.09 | 0.30 | 0.26 | 0.09 | 0.00 | 0.57 | 0.35 | 0.35 | 0.17 | 0.04 |
| POLTCL SCI 320-659 | 0.04 | 0.17 | 0.04 | 0.22 | 0.74 | 0.61 | 0.17 | 0.57 | 0.13 | 0.00 | 0.61 | 0.26 | 0.65 | 0.09 | 0.09 |
| EDUCATION 370-379 | 0.09 | 0.09 | 0.00 | 0.04 | 0.22 | 0.13 | 0.04 | 0.04 | 0.00 | 0.00 | 0.35 | 0.00 | 0.00 | 0.17 | 0.00 |
| LANGUAGE 400-499 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 |
| SCI-ENG 310-699 | 0.00 | 0.26 | 0.13 | 0.22 | 0.22 | 0.26 | 0.13 | 0.57 | 0.13 | 0.00 | 0.13 | 0.13 | 0.26 | 0.22 | 0.30 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | SVS | SPS | SHS | SSS | SFS | SAS | SLS | SBS | STS | THS | TPS | TFS | WCS | WMS | WRS |
| FICTION 813+823 | 0.52 | 0.35 | 1.35 | 1.39 | 0.09 | 0.04 | 0.70 | 0.96 | 0.74 | 0.61 | 0.65 | 2.35 | 0.30 | 0.39 | 1.48 |
| GENERAL 001-099 | 0.00 | 0.00 | 0.04 | 0.09 | 0.00 | 0.00 | 0.09 | 0.00 | 0.09 | 0.13 | 0.22 | 0.35 | 0.04 | 0.04 | 0.00 |
| PHILOSOPHY 100-299 | 0.00 | 0.43 | 0.09 | 0.26 | 0.04 | 0.00 | 0.00 | 0.04 | 0.13 | 0.00 | 0.22 | 0.22 | 0.09 | 0.13 | 0.17 |
| PSYCHOLOGY 130-159 | 0.00 | 0.17 | 0.13 | 0.35 | 0.00 | 0.09 | 0.09 | 0.00 | 0.22 | 0.09 | 0.09 | 0.17 | 0.00 | 0.26 | 0.13 |
| SOCIAL SCI 300-369 | 0.13 | 0.13 | 0.43 | 0.30 | 0.00 | 0.04 | 0.09 | 0.00 | 0.22 | 0.04 | 0.30 | 0.48 | 0.09 | 0.17 | 0.30 |
| POLTCL SCI 320-659 | 0.04 | 0.22 | 0.61 | 0.65 | 0.00 | 0.00 | 0.04 | 0.13 | 0.17 | 0.13 | 0.09 | 0.65 | 0.65 | 0.39 | 0.43 |
| EDUCATION 370-379 | 0.13 | 0.04 | 0.00 | 0.04 | 0.00 | 0.13 | 0.13 | 0.00 | 0.00 | 0.00 | 0.17 | 0.04 | 0.00 | 0.04 | 0.22 |
| LANGUAGE 400-499 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.09 | 0.04 | 0.04 | 0.04 |
| SCI-ENG 310-699 | 0.04 | 0.30 | 0.13 | 0.17 | 0.09 | 0.04 | 0.04 | 0.04 | 0.13 | 0.00 | 0.09 | 0.39 | 0.09 | 0.35 | 0.39 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | WOS | CTC | ELC | GWC | GSU | IBC | MVC | MOC | PSC | ROC | THC | TCC | TRC | ACA | ARA |
| FICTION 813+823 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.26 | 0.00 | 0.00 | 0.09 | 0.17 | 0.04 | 0.04 | 0.00 | 0.00 |
| GENERAL 001-099 | 0.00 | 0.00 | 0.09 | 0.04 | 0.00 | 0.04 | 0.09 | 0.00 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PHILOSOPHY 100-299 | 0.00 | 0.04 | 0.39 | 0.00 | 0.00 | 0.00 | 0.17 | 0.00 | 0.04 | 0.13 | 0.04 | 0.61 | 0.09 | 0.00 | 0.00 |
| PSYCHOLOGY 130-159 | 0.00 | 0.00 | 0.17 | 0.13 | 0.04 | 0.09 | 0.09 | 0.00 | 0.13 | 0.30 | 0.04 | 0.00 | 0.04 | 0.00 | 0.00 |
| SOCIAL SCI 300-369 | 0.00 | 0.00 | 0.22 | 0.26 | 0.00 | 0.22 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 |
| POLTCL SCI 320-659 | 0.00 | 0.00 | 0.52 | 0.09 | 0.04 | 0.26 | 0.09 | 0.00 | 0.04 | 0.43 | 0.00 | 0.04 | 0.04 | 0.00 | 0.00 |
| EDUCATION 370-379 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.22 | 0.00 | 0.17 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| LANGUAGE 400-499 | 0.00 | 0.00 | 0.26 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.04 | 0.04 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 |
| SCI-ENG 310-699 | 0.00 | 0.00 | 0.26 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.70 | 0.00 | 0.00 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

REQUESTING LIBRARIES

| | AMA | BSA | CHA | CIA | ESA | IMA | JMA | IPA | MAA | OFA | OSA | SFA | SGA | TPA | NIL | SIS | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FICTION 813+823 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.35 | 0.00 | 59.70 |
| GENERAL 001-099 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 10.22 |
| PHILOSOPHY 100-299 | 0.00 | 0.17 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 12.39 |
| PSYCHOLOGY 130-159 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 14.48 |
| SOCIAL SCI 300-369 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 16.13 |
| POLTCL SCI 320-659 | 0.00 | 0.17 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 0.00 | 22.48 |
| EDUCATION 370-379 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 6.22 |
| LANGUAGE 400-499 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.52 |
| SCI-ENG 310-699 | 0.09 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 15.65 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | ADS | AMS | BPS | BWS | BKS | BYS | BIS | BVS | BRS | BFS | CCS | CHS | CRS | CLS | COS |
| LIFE SCI 560-639 | 0.17 | 0.13 | 0.00 | 0.09 | 0.00 | 0.04 | 0.13 | 0.04 | 0.09 | 0.04 | 0.04 | 0.22 | 0.09 | 0.17 | 0.17 |
| MEDICL SCI 610-619 | 0.65 | 0.30 | 0.00 | 0.17 | 0.22 | 0.04 | 0.22 | 0.48 | 0.22 | 0.96 | 0.48 | 0.65 | 0.48 | 0.26 | 0.52 |
| HOME ECON 390-649 | 0.39 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.09 | 0.04 | 0.04 | 0.04 | 0.13 | 0.09 | 0.17 | 0.65 |
| ARTS 700-779 | 0.17 | 0.26 | 0.04 | 0.26 | 0.17 | 0.13 | 0.30 | 0.09 | 0.04 | 0.26 | 0.09 | 0.43 | 0.17 | 0.00 | 0.13 |
| MUSIC 780-789 | 0.09 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.04 | 0.04 | 0.04 | 0.00 | 0.09 | 0.00 | 0.00 | 0.04 | 0.09 |
| RECREATION 790-799 | 0.26 | 0.13 | 0.00 | 0.09 | 0.13 | 0.04 | 0.17 | 0.26 | 0.04 | 0.30 | 0.39 | 0.26 | 0.13 | 0.04 | 0.22 |
| LITERATURE 800-899 | 0.13 | 0.13 | 0.00 | 0.22 | 0.00 | 0.22 | 0.04 | 0.09 | 0.09 | 0.13 | 0.04 | 0.30 | 0.13 | 0.09 | 0.09 |
| HISTORY 900-999 | 0.39 | 0.35 | 0.00 | 0.26 | 0.00 | 0.22 | 0.22 | 0.43 | 0.13 | 0.35 | 0.17 | 0.35 | 0.22 | 0.39 | 0.43 |
| BIOGRAPHY 920-929 | 0.26 | 0.17 | 0.00 | 0.35 | 0.09 | 0.13 | 0.13 | 0.35 | 0.30 | 0.17 | 0.35 | 0.00 | 0.04 | 0.74 | 0.65 |
| TOTAL | 5.57 | 3.65 | 0.83 | 2.70 | 2.22 | 1.65 | 3.04 | 5.96 | 2.04 | 4.57 | 5.22 | 5.35 | 3.13 | 4.35 | 6.48 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| CLASS | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CWS | CTS | DOS | DGS | ECS | ESS | EHS | EPS | EVS | FCS | FMS | FPS | FRS | GWS | GHS |
| LIFE SCI 560-639 | 0.00 | 0.00 | 0.22 | 0.13 | 0.00 | 0.09 | 0.30 | 0.17 | 0.30 | 0.17 | 0.26 | 0.04 | 0.09 | 0.04 | 0.09 |
| MEDICL SCI 610-619 | 0.00 | 0.17 | 0.39 | 0.61 | 0.00 | 0.83 | 0.61 | 0.78 | 0.43 | 0.43 | 0.39 | 0.13 | 0.13 | 0.30 | 0.91 |
| HOME ECON 390-649 | 0.00 | 0.13 | 0.09 | 0.30 | 0.00 | 0.13 | 0.17 | 0.17 | 0.04 | 0.13 | 0.17 | 0.09 | 0.04 | 0.22 | 0.13 |
| ARTS 700-779 | 0.17 | 0.04 | 0.30 | 0.35 | 0.04 | 0.09 | 0.61 | 0.13 | 0.61 | 0.09 | 0.52 | 0.04 | 0.39 | 0.09 | 0.13 |
| MUSIC 780-789 | 0.00 | 0.09 | 0.04 | 0.00 | 0.00 | 0.04 | 0.04 | 0.04 | 0.04 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 |
| RECREATION 790-799 | 0.04 | 0.04 | 0.17 | 0.13 | 0.00 | 0.30 | 0.30 | 0.22 | 0.22 | 0.26 | 0.09 | 0.04 | 0.22 | 0.09 | 0.09 |
| LITERATURE 800-899 | 0.00 | 0.39 | 0.65 | 0.13 | 0.04 | 0.17 | 0.09 | 0.30 | 0.17 | 0.26 | 0.22 | 0.00 | 0.17 | 0.04 | 0.17 |
| HISTORY 900-999 | 0.22 | 0.04 | 0.48 | 0.39 | 0.00 | 0.17 | 0.87 | 0.26 | 0.17 | 0.57 | 0.35 | 0.17 | 0.26 | 0.22 | 0.17 |
| BIOGRAPHY 920-929 | 0.09 | 0.04 | 0.52 | 1.43 | 0.00 | 0.17 | 1.39 | 0.17 | 0.09 | 0.39 | 0.35 | 0.13 | 0.30 | 1.43 | 0.13 |
| TOTAL | 1.43 | 2.04 | 7.00 | 6.13 | 0.17 | 4.09 | 8.61 | 5.13 | 4.61 | 6.70 | 5.22 | 1.65 | 3.13 | 4.00 | 5.17 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | HAS | HSS | HDS | HKS | HTS | HWS | LGS | LPS | LSS | LDS | LYS | MCS | MKS | MTS | MWS |
| LIFE SCI 560-639 | 0.30 | 0.04 | 0.04 | 0.00 | 0.26 | 0.04 | 0.22 | 0.22 | 0.00 | 0.35 | 0.04 | 0.00 | 0.00 | 0.00 | 0.04 |
| MEDICL SCI 610-619 | 0.35 | 0.04 | 0.35 | 0.00 | 0.13 | 0.48 | 0.43 | 0.65 | 0.09 | 0.52 | 0.09 | 0.00 | 0.22 | 0.09 | 0.09 |
| HOME ECON 390-649 | 0.13 | 0.00 | 0.04 | 0.00 | 0.04 | 0.00 | 0.30 | 0.83 | 0.13 | 0.04 | 0.00 | 0.00 | 0.04 | 0.09 | 0.09 |
| ARTS 700-779 | 0.04 | 0.13 | 0.39 | 0.00 | 0.09 | 0.13 | 0.65 | 0.96 | 0.22 | 0.26 | 0.00 | 0.00 | 0.39 | 0.09 | 0.04 |
| MUSIC 780-789 | 0.09 | 0.09 | 0.00 | 0.00 | 0.00 | 0.04 | 0.17 | 0.13 | 0.00 | 0.09 | 0.22 | 0.00 | 0.00 | 0.09 | 0.00 |
| RECREATION 790-799 | 0.13 | 0.00 | 0.04 | 0.00 | 0.04 | 0.09 | 0.13 | 0.39 | 0.04 | 0.22 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 |
| LITERATURE 800-899 | 0.09 | 0.00 | 0.57 | 0.00 | 0.04 | 0.35 | 0.17 | 0.57 | 0.00 | 0.09 | 0.09 | 0.00 | 0.09 | 0.09 | 0.30 |
| HISTORY 900-999 | 0.22 | 0.30 | 0.35 | 0.00 | 0.09 | 0.65 | 0.52 | 0.74 | 0.26 | 0.13 | 0.04 | 0.00 | 0.09 | 0.13 | 0.17 |
| BIOGRAPHY 920-929 | 0.74 | 0.04 | 0.22 | 0.00 | 0.13 | 0.43 | 0.35 | 0.22 | 0.04 | 0.22 | 0.09 | 0.00 | 0.13 | 0.22 | 0.22 |
| TOTAL | 3.30 | 1.30 | 3.48 | 0.00 | 1.78 | 4.43 | 6.04 | 9.17 | 2.48 | 4.61 | 1.91 | 0.00 | 3.00 | 2.04 | 2.91 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | MPS | MDS | MLS | OLS | OPS | ORS | PHS | PFS | PSS | ROS | RFS | RGS | RDS | RSS | RPS |
| LIFE SCI 560-639 | 0.00 | 0.00 | 0.00 | 0.04 | 0.04 | 0.04 | 0.17 | 0.26 | 0.13 | 0.00 | 0.13 | 0.04 | 0.00 | 0.04 | 0.00 |
| MEDICL SCI 610-619 | 0.04 | 0.13 | 0.13 | 0.00 | 0.78 | 0.35 | 0.39 | 0.26 | 0.00 | 0.00 | 0.30 | 0.22 | 0.35 | 0.30 | 0.09 |
| HOME ECON 390-649 | 0.00 | 0.17 | 0.13 | 0.00 | 0.09 | 0.17 | 0.13 | 0.22 | 0.04 | 0.00 | 0.17 | 0.04 | 0.13 | 0.17 | 0.09 |
| ARTS 700-779 | 0.00 | 0.04 | 0.22 | 0.00 | 0.35 | 0.04 | 0.61 | 0.22 | 0.26 | 0.00 | 0.22 | 0.22 | 0.09 | 0.26 | 0.04 |
| MUSIC 780-789 | 0.00 | 0.57 | 0.00 | 0.00 | 0.17 | 0.04 | 0.04 | 0.04 | 0.00 | 0.00 | 0.09 | 0.04 | 0.26 | 0.17 | 0.00 |
| RECREATION 790-799 | 0.04 | 0.09 | 0.00 | 0.04 | 0.13 | 0.04 | 0.09 | 0.09 | 0.26 | 0.09 | 0.39 | 0.26 | 0.22 | 0.17 | 0.09 |
| LITERATURE 800-899 | 0.04 | 0.09 | 0.04 | 0.00 | 0.52 | 0.13 | 0.09 | 0.09 | 0.04 | 0.00 | 0.26 | 0.04 | 0.26 | 0.13 | 0.00 |
| HISTORY 900-999 | 0.13 | 0.22 | 0.04 | 0.13 | 0.57 | 0.43 | 0.09 | 0.17 | 0.91 | 0.00 | 0.48 | 0.26 | 0.43 | 0.22 | 0.09 |
| BIOGRAPHY 920-929 | 0.04 | 1.04 | 0.00 | 1.17 | 0.48 | 0.22 | 0.22 | 1.00 | 0.00 | 0.00 | 0.39 | 0.09 | 0.57 | 0.65 | 0.04 |
| TOTAL | 1.04 | 5.04 | 1.65 | 2.52 | 7.30 | 3.91 | 3.22 | 5.52 | 2.39 | 0.09 | 6.00 | 3.09 | 5.26 | 3.78 | 1.48 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | SVS | SPS | SHS | SSS | SFS | SAS | SLS | SBS | STS | THS | TPS | TFS | WCS | WMS | WRS |
| LIFE SCI 560-639 | 0.04 | 0.00 | 0.13 | 0.17 | 0.00 | 0.09 | 0.00 | 0.17 | 0.26 | 0.13 | 0.00 | 0.04 | 0.00 | 0.04 | 0.35 |
| MEDICL SCI 610-619 | 0.22 | 0.13 | 0.39 | 0.48 | 0.04 | 0.00 | 0.13 | 0.09 | 0.39 | 0.13 | 0.17 | 1.09 | 0.35 | 0.26 | 0.48 |
| HOME ECON 390-649 | 0.04 | 0.17 | 0.30 | 0.22 | 0.00 | 0.00 | 0.09 | 0.04 | 0.17 | 0.00 | 0.26 | 0.17 | 0.13 | 0.13 | 0.48 |
| ARTS 700-779 | 0.35 | 0.17 | 0.09 | 0.13 | 0.04 | 0.00 | 0.04 | 0.22 | 0.30 | 0.17 | 0.22 | 0.30 | 0.13 | 0.09 | 0.61 |
| MUSIC 780-789 | 0.00 | 0.00 | 0.04 | 0.04 | 0.00 | 0.00 | 0.35 | 0.04 | 0.00 | 0.04 | 0.00 | 0.04 | 0.00 | 0.00 | 0.09 |
| RECREATION 790-799 | 0.13 | 0.04 | 0.13 | 0.30 | 0.00 | 0.00 | 0.13 | 0.09 | 0.13 | 0.00 | 0.26 | 0.39 | 0.13 | 0.30 | 0.22 |
| LITERATURE 800-899 | 0.04 | 0.04 | 0.17 | 0.09 | 0.00 | 0.00 | 0.17 | 0.00 | 0.17 | 0.09 | 0.04 | 0.35 | 0.09 | 0.09 | 0.13 |
| HISTORY 900-999 | 0.04 | 0.00 | 0.43 | 0.43 | 0.00 | 0.09 | 0.04 | 0.04 | 0.26 | 0.09 | 0.17 | 0.87 | 0.04 | 0.00 | 0.26 |
| BIOGRAPHY 920-929 | 0.13 | 0.13 | 0.43 | 0.09 | 0.00 | 0.04 | 0.09 | 0.04 | 0.61 | 0.13 | 0.26 | 0.96 | 0.30 | 0.17 | 0.52 |
| TOTAL | 1.87 | 2.43 | 4.91 | 5.22 | 0.39 | 0.57 | 2.22 | 1.91 | 4.00 | 1.78 | 3.26 | 8.96 | 2.48 | 2.91 | 6.30 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | WOS | CTC | ELC | GWC | GSU | IBC | MVC | MOC | PSC | ROC | THC | TCC | TRC | ACA | ARA |
| LIFE SCI 560-639 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 |
| MEDICL SCI 610-619 | 0.00 | 0.00 | 1.22 | 0.13 | 0.04 | 0.04 | 0.09 | 0.09 | 0.00 | 0.70 | 0.00 | 0.04 | 0.09 | 0.00 | 0.00 |
| HOME ECON 390-649 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ARTS 700-779 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MUSIC 780-789 | 0.00 | 0.00 | 0.39 | 0.17 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 |
| RECREATION 790-799 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.09 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| LITERATURE 800-899 | 0.00 | 0.00 | 0.26 | 0.00 | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 | 0.17 | 0.04 | 0.04 | 0.04 | 0.00 | 0.00 |
| HISTORY 900-999 | 0.00 | 0.00 | 0.22 | 0.04 | 0.00 | 0.04 | 0.13 | 0.00 | 0.00 | 0.04 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 |
| BIOGRAPHY 920-929 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 |
| TOTAL | 0.00 | 0.04 | 4.26 | 0.96 | 0.35 | 0.83 | 1.65 | 0.09 | 0.61 | 2.39 | 0.30 | 1.09 | 1.17 | 0.00 | 0.00 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Continued)

| | REQUESTING LIBRARIES | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AMA | BSA | CHA | CIA | ESA | IMA | JMA | IPA | MAA | OFA | OSA | SFA | SGA | TPA | NIL | SIS | TOT |
| LIFE SCI 560-639 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 7.48 |
| MEDICL SCI 610-619 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 25.48 |
| HOME ECON 390-649 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 9.35 |
| ARTS 700-779 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 15.30 |
| MUSIC 780-789 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.52 |
| RECREATION 790-799 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.43 |
| LITERATURE 800-899 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.87 |
| HISTORY 900-999 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 19.52 |
| BIOGRAPHY 920-929 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 23.78 |
| TOTAL | 0.17 | 0.48 | 0.04 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.91 | 0.13 | 285.52 |

Table 3.1 March 1978 Demand: Dewey Class by Requesting Libraries
(Average Number of Requests per Day)

Model of Intralibrary Processing

Thus far, most of our attention has focused on the level of activity between SLS ILL and the local level requesting libraries. In addition to the level of demand at SLS ILL, we are also interested in network services as defined by the performance measures mentioned earlier in this chapter. In the remainder of this report we will focus on the intralibrary activity of SLS ILL as a requesting library as well as a resource library, in addition to the other resource libraries, which attempt to satisfy interlibrary loan requests. We will describe the SLS internal model which captures the essence of interlibrary loan processing at SLS ILL. From the model we can evaluate the significant internal processing activities and the amount of time required per request. A detailed model of SLS ILL is developed as an aid to management decision making where control over these internal activities may result in policy changes governing the internal procedures. Since SLS ILL has no comparable control over the internal processing activities within network resource libraries, we present simplified models of internal processing for these libraries. Overall, we describe two models of intralibrary processing, one which describes SLS ILL and another which characterizes other resource libraries in the network.

Based on the data collected for this case study, we find that we can adapt the general intralibrary model given in Figure 3.2. The following data were collected describing SLS ILL internal processing activities:

1. number of data bases searched
2. number of requests verified by SLS ILL
3. number of non-reserve/purchase requests obtained from the SLS ILL collection
4. number of purchase requests processed by SLS ILL
5. number of reserve non-purchase requests processed by SLS ILL (owned by SLS ILL)
6. processing times which include the search, verification, obtain, reserve, purchase activities.

From this data we were able to calculate processing times related to reserve, purchase, and other (on-shelf) items. These times are calculated from requests with complete date information for which SLS was the first resource library contacted in the referral route. Estimates from this data appear in Table 3.2.

| | RESERVE | | | PURCHASE | | | ON-SHELF | | |
|---|---|---|---|---|---|---|---|---|---|
| | AVG. | STD. | N | AVG. | STD. | N | AVG. | STD. | N |
| INITIAL PROCESSING TIME: | | | | | | | | | |
| SATISFIED | 3.76 | 12.18 | 318 | 27.71 | 26.85 | 237 | 0.59 | 1.71 | 353 |
| UNSATISFIED | 9.25 | 20.13 | 39 | 55.79 | 56.19 | 48 | 1.50 | 2.65 | 7 |
| RESOURCE LIBRARY TIME: | | | | | | | | | |
| SATISFIED | 49.60 | 43.67 | 318 | 47.77 | 30.62 | 237 | 1.17 | 3.74 | 353 |
| UNSATISFIED | 69.83 | 25.73 | 21 | 103.12 | 42.28 | 16 | 5.30 | 10.73 | 5 |

Table 3.2 SLS ILL Initial and Resource Library Processing Times (Days)

We also analyzed the processing times in Table 3.2 by a third dimension, namely whether or not SLS ILL encountered the verification activity. We found significant differences in processing times for reserve, purchase and on-shelf items. Based on this breakdown of requests with complete date information, we found the following time estimates of activities within SLS ILL:

1. on-shelf obtain activity, 1.17 days (std. dev.=3.79, n=343)
2. reserve activity, 50.31 days (std. dev.=44.29, n=299)
3. purchase activity, 46.50 days (std. dev.=30.52, n=213)

These time estimates are based on satisfied requests only because there were too few unsatisfied requests processed by SLS ILL as the resource library with complete date information.

The initial processing time estimates include both the search and verification activities. We needed to know if search and verification activities should be represented in the model as one activity or two distinct activities. We first analyzed the data to determine if the number of data bases searched was statistically sensitive to whether or not the verification activity was encountered by SLS ILL. A significant difference in number of data bases searched was found to be related to whether or not verification was encountered. We eliminated from our analysis requests which encountered no data base searching and no resource library contacted, (i.e., cancelled without routing).

Average number of data bases searched was also analyzed by a second dimension, namely, whether or not the request was processed by SLS as the first resource library in the route. These calculations enabled us to estimate that an average of approximately 3 data bases are searched for requests which are received by SLS ILL and which are forwarded to a resource library other than SLS as the first resource library. Requests which encounter SLS as the first resource library experience an average of approximately 1.5 data bases if verification is not encountered, and 6 data bases with verification.

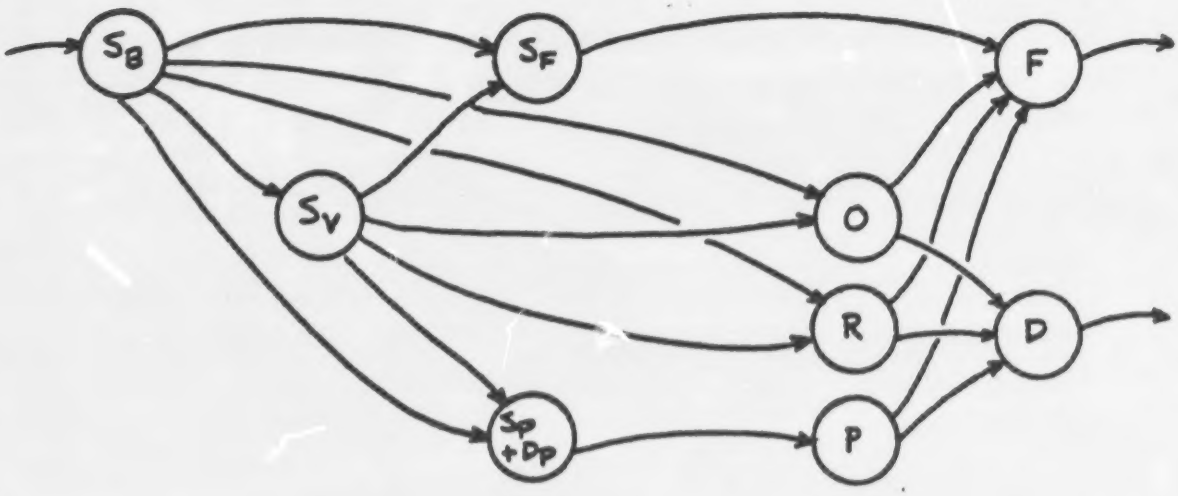
Thus far we have roughly identified the need for representing the following separate activities within SLS ILL:

1. search
2. verification
3. obtain
4. reserve
5. purchase.

Analysis of corresponding processing times within SLS ILL would enable us to refine the model for a more accurate representation. We were able to identify the complete intralibrary pattern for each request, for example, entry, search, verification, purchase, send document. The corresponding time to complete these requests was found by the difference between the first reply date and the initial received date. Combining the time estimates for complete intralibrary patterns together with our previous estimates of individual activities enabled us to obtain the time estimates

allocated to the search and verify activities, and determine whether or not additional processing activities should be included in the model. The resulting model of SLS ILL intralibrary processing activities appears in Figure 3.3. Table 3.3 includes the time estimates for individual processing activities. Based on the data in Table 3.3, this model predicts SLS ILL intralibrary processing time with less than 1% error.

The initial processing times for purchase requests and forwarded requests indicated additional processing activity which required the additional node representations, $S_p+D_p$ and $S_F$ in Figure 3.3.




$S_B$ basic search
$S_V$ verification search
$S_F$ forward search
O obtain item from shelf
R reserve item
$S_p+D_p$ purchase search and purchase decision
P purchase item
F forwarding of unsatisfied request
D send document

Figure 3.3 Model of SLS ILL Intralibrary Processing

The $S_p+D_p$ activity is a composite activity of purchase search and purchase decision. The $S_F$ represents an activity which accounts for additional processing time following the basic search activity for requests which are not owned by SLS and forwarded to another resource library.

| PROCESSING ACTIVITY | ESTIMATE |
|---|---|
| $S_B$ | 0.82 |
| $S_V$ | 13.28 |
| $S_F$ | 2.11 |
| $S_P+D_P$ | 10.90 |
| O | 1.17 |
| R | 50.31 |
| P | 46.50 |

Table 3.3 Time Estimates for SLS ILL Processing Activities (Days)

In addition to time estimates related to the model in Figure 3.3, it is also helpful to know, for example, the probability of forwarding an unsatisfied request which encountered verification at SLS ILL. From Table 3.4, we find the transition probabilities associated with the intralibrary model. The probability of forwarding an unsatisfied request which encountered verification is defined as a request transitioning <u>from</u> the verify activity (left column of Table 3.4) <u>to</u> the forward search activity (top row of Table 3.4). The intersecting cell indicates that 80% of the requests which encounter verification at SLS ILL are unowned and forwarded to a resource library, or returned unsatisfied to the requesting library. The numbers in parentheses indicate the number of requests associated with the transition probabilities. Thus, of 1,641 requests which encountered verification, 1,318 were forwarded as unsatisfied requests. And similarly, of the

| From: \ To: | Basic Search | Forward Search | Verify | Purchase Search* | Obtain | Reserve | Purchase | Forward | Send Document | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Basic Search | - | .63 | .25 | .007 | .06 | .05 | - | - | - | - |
| | - | (4158) | (1641) | (43) | (385) | (340) | - | - | - | (6567) |
| Forward Search | - | - | - | - | - | - | - | 1.0 | - | - |
| | - | - | - | - | - | - | - | (5476) | - | (5476) |
| Verify | - | .80 | - | .16 | .02 | .02 | - | - | - | - |
| | - | (1318) | - | (265) | (30) | (28) | - | - | - | (1641) |
| Purchase Search* | - | - | - | - | - | - | 1.0 | - | - | - |
| | - | - | - | - | - | - | (308) | - | - | (308) |
| Obtain | - | - | - | - | - | - | - | .04 | .96 | - |
| | - | - | - | - | - | - | - | (17) | (398) | (415) |
| Reserve | - | - | - | - | - | - | - | .11 | .89 | - |
| | - | - | - | - | - | - | - | (39) | (329) | (368) |
| Purchase | - | - | - | - | - | - | - | .16 | .84 | - |
| | - | - | - | - | - | - | - | (48) | (260) | (308) |

Total Number of Requests = 6567
*Note: Purchase search indicates a composite activity which consists of the data base search activity and the librarian's purchase decision activity.

Table 3.4 Requests Processed Within SLS -
Probability of Requests Transitioning Between Processing Activities

6,567 requests which encountered the basic search, a total of 4,158 were forwarded as unsatisfied requests. For convenience, this table is provided in Appendix D with breakdowns by subject class.

The data from this table and the model help us identify the time consuming activities for requests received by SLS ILL. Appropriate changes in internal procedures can be suggested, based on this data as an aid to managers of SLS ILL. Requests owned by SLS ILL and obtained from the shelf without encountering verification, require an average of 1.99 days (0.82 + 1.17, from Table 3.3). If verification is required for requests owned and found on-shelf at SLS, we can expect an average of 13.28 additional days, or 15.27 total. While 1.99 days is quite admirable, we find that only 6% of the requests received at SLS encounter this route. Thus, if SLS is interested in improving their service with respect to processing time, we find that relatively large numbers of requests include reserve and purchase, where relatively long processing times are also encountered. For example, a request which encounters the basic search, verification, purchase search and purchase decision, and purchase activity will take an average of 71.50 days to complete at SLS ILL. If SLS ILL does not have much control over the actual time it takes to purchase items, one might consider policies which will decrease the time prior to the actual purchase activity (an average of 25 days).

With respect to reserve requests, we find that the average request owned by SLS and reserved at SLS experiences an average of 50.31 days during the reserve process. Given a request which encounters a basic search and reserved by SLS ILL, we can expect an averge of 51.13 days for processing the request, with 89% probability of satisfying the request. Of the 394 requests reserved at SLS ILL, 26% were found on-shelf at another location. (This figure is based on the on-shelf locations found in the computer readable data bases, and the ownership locations found in other data bases.) SLS might consider a change in their policy of exhausting their own resources before contacting other libraries. For example, a minimum of one week might be imposed on SLS reserve items found on-shelf elsewhere before processing the item as a forward request to the resource library with the on-shelf location.

From Table 3.4, we find that 25% of the requests which encounter the basic search are also verified by SLS which alone consumes 13.28 days. SLS might consider policies aimed at decreasing the amount of time required for verifying requests.

Thus far we have described the intralibrary processing model of SLS ILL which will be used by the model in predicting network performance measures discussed in Chapter Four. In the remainder of this chapter, we will describe the intralibrary processing model which represents resource libraries other than SLS. Because our data collection did not include as much detail regarding resource libraries, our resource library intralibrary model is necessarily simplified.

Requests received by SLS ILL during March 1978 were processed by 61 unique resource libraries. Since some of these libraries processed very few requests, we had to aggregate those libraries in order to obtain reliable statistical analyses. (See Report No. 5 in this series for a discussion of statistical issues.) We also grouped some libraries on the basis of type of library, such as the Special Resource Libraries, e.g., John Crerar and Northwestern University, rather than aggregating them with other SLS member libraries. Table 3.5 lists the 20 resource library abbreviations used throughout this report, and their aggregate members.

| ABBREVIATION | AGGREGATION |
|---|---|
| ARV | |
| DGS | |
| DOS | |
| EHS | |
| EPS | |
| ESS | |
| GSU | |
| HAS | |
| INT[1] | NSL, NIL, RPL |
| ISL | |
| NLS | |
| OLS | |
| OPS | |
| OSL | |
| OTI[2] | IHL, OTL, SHW |
| PFS | |
| RCO[3] | CPL, SIU, JCL, NWL, UCL, UIM |
| SLS | SLS, SBS, SIS |
| UOI | |
| OSR[4] | AMS, LSS, FRS, CTS, LGS, CTC, EVS, LDS, LPS, MWS, HDS, BVS, MVC, SPS, GWS, FCS, HSS, FRS, TRC, BIS, ROC, SAS, COS, HWS, IBC, WRS, RSS, RFS, OFA, WMS, ELC |

1 INT = Interconnect libraries with exception of ISL
2 OTI = Other Illinois libraries
3 RCO = Research Centers Other
4 OSR = Other Suburban member resource libraries

Table 3.5 Aggregated Resource Libraries

We found that very few requests are sent by SLS to resource libraries without previous knowledge that the item is owned by that resource library. Out of 6149 requests processed by other resource libraries, 8% were sent blind by SLS ILL. That is, ownership was not determined for 8% of the requests leaving SLS. This means that nearly all requests leaving SLS ILL for a resource library will be owned by that resource library. Thus, probability of ownership as a function of which resource library receives the request is very close to 1.0.

We can also express probability of ownership as a function of searching a data base. Probability of ownership given a data base search was determined for 23 out of the original 61 resource libraries from ownership information contained in 15 out of the 23 possible data bases listed in Table 2.4. Ownership could be determined from the computer-readable data bases, accounting for 18 libraries, the MACs, accounting for 3 libraries, and RCEN, accounting for ARV, and SHB, accounting for SHW. Table 3.6 indicates probability of ownership by the aggregated resource libraries given a search of the appropriate data bases. We find from this table that GSU and OSL have probabilities of 0.0 because we cannot assume that a search of SUC, for example, which may result in identifying PFS means that GSU does <u>not</u> own the item.

Once a resource library receives a request which is owned, we found the overall probability of satisfying the item, or probability of availability given the request is owned.

| | RESOURCE LIBRARY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | ARV | DGS | DOS | EHS | EPS | ESS | GSU | HAS | INT | ISL |
| FICTION (813+823) | .00 | .28 | .36 | .33 | .21 | .22 | .00 | .45 | .06 | .08 |
| GENERAL (001-099) | .00 | .07 | .19 | .04 | .08 | .06 | .00 | .14 | .05 | .23 |
| PHILOSOPHY (100-299) | .00 | .02 | .11 | .10 | .04 | .07 | .00 | .14 | .04 | .18 |
| PSYCHOLOGY (130-159) | .00 | .17 | .25 | .23 | .16 | .13 | .00 | .28 | .03 | .17 |
| SOCIAL SCI (300-369) | .00 | .17 | .26 | .22 | .15 | .13 | .00 | .29 | .05 | .20 |
| POLTCL SCI (320-659) | 1.00 | .10 | .12 | .16 | .09 | .06 | .00 | .14 | .06 | .28 |
| EDUCATION (370-379) | .00 | .18 | .13 | .18 | .08 | .08 | .00 | .14 | .05 | .22 |
| LANGUAGE (400-499) | .00 | .05 | .20 | .00 | .00 | .11 | .00 | .16 | .04 | .24 |
| SCI-ENG (310-699) | 1.00 | .05 | .14 | .10 | .04 | .06 | .00 | .13 | .05 | .16 |
| LIFE SCI (560-639) | .00 | .14 | .16 | .20 | .10 | .10 | .00 | .12 | .04 | .24 |
| MEDICL SCI (610-619) | .00 | .10 | .22 | .19 | .17 | .10 | .00 | .24 | .06 | .16 |
| HOME ECON (390-649) | .00 | .20 | .28 | .24 | .18 | .17 | .00 | .27 | .09 | .21 |
| ARTS (700-779) | .00 | .09 | .11 | .17 | .08 | .07 | .00 | .13 | .05 | .25 |
| MUSIC (780-789) | .00 | .12 | .08 | .18 | .03 | .05 | .00 | .09 | .02 | .19 |
| RECREATION (790-799) | .00 | .11 | .17 | .29 | .11 | .08 | .00 | .28 | .10 | .20 |
| LITERATURE (800-899) | .00 | .17 | .17 | .26 | .06 | .17 | .00 | .18 | .05 | .16 |
| HISTORY (900-999) | .00 | .12 | .14 | .16 | .11 | .12 | .00 | .17 | .07 | .19 |
| BIOGRAPHY (920-929) | 1.00 | .12 | .16 | .21 | .10 | .14 | .00 | .23 | .01 | .08 |
| TOTAL/LIBRARY | 1.00 | .15 | .21 | .21 | .13 | .13 | .00 | .25 | .05 | .18 |

Table 3.6: Probability of Ownership given a Database Search (Continued)

| | RESOURCE LIBRARY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | NLS | OLS | OPS | OSL | OTI | PFS | RCO | SLS | UOI | OSR | TOTAL |
| FICTION (813+823) | .18 | .32 | .47 | .00 | .00 | .39 | .09 | .12 | .22 | .10 | .26 |
| GENERAL (001-099) | .04 | .09 | .25 | .00 | .00 | .12 | .71 | .30 | .79 | .06 | .15 |
| PHILOSOPHY (100-299) | .04 | .11 | .21 | .00 | .00 | .15 | .19 | .10 | .48 | .02 | .10 |
| PSYCHOLOGY (130-159) | .14 | .22 | .45 | .00 | .00 | .30 | .25 | .20 | .55 | .05 | .20 |
| SOCIAL SCI (300-369) | .13 | .25 | .50 | .00 | .00 | .29 | .31 | .14 | .48 | .09 | .20 |
| POLTCL SCI (320-659) | .03 | .12 | .35 | .00 | .00 | .17 | .25 | .14 | .37 | .01 | .12 |
| EDUCATION (370-379) | .06 | .06 | .36 | .00 | .00 | .22 | .43 | .10 | .27 | .05 | .13 |
| LANGUAGE (400-499) | .00 | .00 | .22 | .00 | .00 | .12 | .50 | .07 | .75 | .00 | .09 |
| SCI-ENG (310-699) | .04 | .14 | .33 | .00 | .50 | .17 | .18 | .03 | .32 | .04 | .11 |
| LIFE SCI (560-639) | .09 | .14 | .37 | .00 | .00 | .23 | .11 | .05 | .32 | .03 | .13 |
| MEDICL SCI (610-619) | .08 | .18 | .45 | .00 | .00 | .27 | .32 | .25 | .21 | .04 | .18 |
| HOME ECON (390-649) | .14 | .15 | .42 | .00 | .00 | .29 | .25 | .16 | .43 | .05 | .20 |
| ARTS (700-779) | .05 | .16 | .31 | .00 | .00 | .30 | .18 | .10 | .20 | .03 | .13 |
| MUSIC (780-789) | .06 | .19 | .36 | .00 | .00 | .30 | .20 | .05 | .64 | .04 | .13 |
| RECREATION (790-799) | .08 | .33 | .41 | .00 | .00 | .32 | .14 | .16 | .25 | .05 | .18 |
| LITERATURE (800-899) | .07 | .14 | .36 | .00 | .00 | .38 | .00 | .07 | .66 | .04 | .16 |
| HISTORY (900-999) | .08 | .13 | .32 | .00 | 1.00 | .31 | .32 | .06 | .60 | .03 | .14 |
| BIOGRAPHY (920-929) | .17 | .23 | .37 | .00 | .78 | .32 | .03 | .19 | .16 | .07 | .20 |
| TOTAL/LIBRARY | .10 | .19 | .39 | .00 | .76 | .29 | .22 | .13 | .41 | .05 | .82 |

Table 3.6: Probability of Ownership Given a Database Search

Thus, from Table 3.7 we find that requests processed by the Suburban network will experience a .82 probability of availability given the request is owned by the resource library contacted.

The model of intralibrary processing for resource libraries is illustrated in Figure 3.4. Since reserve requests were found to require an overall average of 22.54 days to process at the resource libraries, we included the reserve processing activity in the model. Because our resource library data does not indicate the same level of detail of intralibrary processing as SLS ILL, we cannot describe resource library processing at the same level of analysis. Nevertheless, the model of resource library processing reflects the significant time consuming activity for reserves. It does not include any search or verification activities, because we found only 8% of the requests were forwarded to resource libraries without previous knowledge of ownership. Table 3.8 indicates the processing times found for resource libraries receiving non-reserve, owned items. Thus, the average resource library will satisfy a non-reserve, owned request in 7.72 days and an unsatisfied request will be processed in 9.15 days. From Table 3.8, we find that SLS has the longest processing time for owned reserve requests (50.08 days) among the SLS member libraries, with the exception of GSU, which only includes complete date information for one request that was owned and reserved.

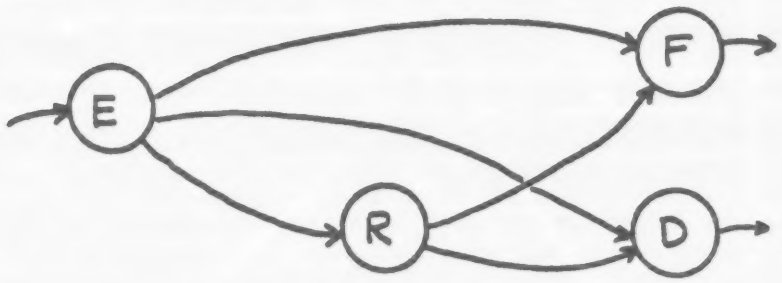
| | | RESOURCE LIBRARY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | | ARV | DGS | DOS | EHS | EPS | ESS | GSU | HAS | INT | ISL |
| FICTION | (813+823) | .00 | .53 | .84 | .69 | .88 | .93 | .70 | .93 | .67 | .85 |
| GENERAL | (001-099) | .00 | .67 | .33 | .00 | 1.00 | 1.00 | .33 | .80 | .00 | .65 |
| PHILOSOPHY | (100-299) | .00 | .00 | .80 | .92 | .75 | 1.00 | .92 | 1.00 | .50 | .83 |
| PSYCHOLOGY | (130-159) | .00 | .40 | .80 | .61 | 1.00 | 1.00 | .70 | .85 | .20 | .79 |
| SOCIAL SCI | (300-369) | .00 | .15 | .56 | .50 | .78 | 1.00 | .74 | 1.00 | .83 | .81 |
| POLTCL SCI | (320-659) | .00 | .67 | .75 | .69 | 1.00 | .80 | .72 | .92 | .67 | .86 |
| EDUCATION | (370-379) | .00 | .71 | 1.00 | .75 | 1.00 | .67 | .58 | 1.00 | .50 | .89 |
| LANGUAGE | (400-499) | .00 | .00 | 1.00 | .00 | .00 | 1.00 | .50 | 1.00 | .00 | .86 |
| SCI-ENG | (310-699) | 1.00 | 1.00 | .67 | .67 | .75 | 1.00 | .60 | 1.00 | .67 | .87 |
| LIFE SCI | (560-639) | .00 | .86 | .75 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | .83 |
| MEDICL SCI | (610-619) | .00 | .60 | .75 | .74 | .83 | .83 | .42 | .96 | .78 | .83 |
| HOME ECON | (390-649) | .00 | .50 | .86 | .60 | 1.00 | 1.00 | .25 | .94 | .50 | .74 |
| ARTS | (700-779) | .00 | .63 | .73 | .58 | .75 | 1.00 | .33 | .92 | .55 | .80 |
| MUSIC | (780-789) | .00 | .75 | 1.00 | .75 | .00 | 1.00 | .00 | 1.00 | .00 | .80 |
| RECREATION | (790-799) | .00 | .57 | .75 | .75 | 1.00 | .80 | .00 | 1.00 | .63 | .80 |
| LITERATURE | (800-899) | .00 | .88 | .86 | .78 | 1.00 | .88 | .67 | 1.00 | .60 | .94 |
| HISTORY | (900-999) | .00 | .79 | .75 | .67 | 1.00 | .94 | 1.00 | .94 | .56 | .93 |
| BIOGRAPHY | (920-929) | .83 | .71 | .67 | .63 | 1.00 | .91 | .50 | 1.00 | 1.00 | .87 |
| TOTAL/LIBRARY | | .83 | .59 | .77 | .69 | .89 | .93 | .66 | .95 | .61 | .84 |

Table 3.7: Probability of Availability Given Ownership
(Continued)

RESOURCE LIBRARY

| CLASS | | NLS | OLS | OPS | OSL | OTI | PFS | RCO | SLS | UOI | OSR | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FICTION | (813+823) | .66 | .81 | .60 | .63 | .60 | .77 | .86 | .99 | .95 | .82 | .76 |
| GENERAL | (001-099) | 1.00 | 1.00 | .79 | .00 | .50 | .75 | .73 | .97 | .71 | .75 | .78 |
| PHILOSOPHY | (100-299) | .83 | 1.00 | .71 | .57 | .80 | .81 | .80 | .92 | .80 | 1.00 | .82 |
| PSYCHOLOGY | (130-159) | .89 | .83 | .54 | .00 | 1.00 | .67 | .83 | .98 | .83 | .56 | .73 |
| SOCIAL SCI | (300-369) | .86 | 1.00 | .62 | 1.00 | 1.00 | .83 | .56 | .93 | .88 | .93 | .75 |
| POLTCL SCI | (320-659) | 1.00 | .82 | .72 | .50 | .00 | .89 | .46 | .96 | .88 | 1.00 | .80 |
| EDUCATION | (370-379) | .00 | .67 | .76 | 1.00 | .00 | .78 | .86 | 1.00 | .94 | .67 | .80 |
| LANGUAGE | (400-499) | .00 | .00 | .80 | 1.00 | .00 | .00 | 1.00 | 1.00 | .86 | .00 | .82 |
| SCI-ENG | (310-699) | 1.00 | .81 | .80 | .50 | 1.00 | .83 | .69 | 1.00 | .78 | .89 | .80 |
| LIFE SCI | (560-639) | 1.00 | .88 | .51 | 1.00 | .00 | .83 | .50 | .88 | .75 | .75 | .78 |
| MEDICL SCI | (610-619) | 1.00 | .63 | .60 | .33 | .50 | .80 | .62 | .96 | .65 | .67 | .71 |
| HOME ECON | (390-649) | 1.00 | .83 | .70 | 1.00 | 1.00 | .74 | .33 | .97 | .63 | .67 | .76 |
| ARTS | (700-779) | .25 | .85 | .63 | 1.00 | .50 | .75 | .33 | .93 | .60 | .71 | .73 |
| MUSIC | (780-789) | 1.00 | .86 | .52 | .67 | .00 | .71 | .75 | 1.00 | .65 | .78 | .71 |
| RECREATION | (790-799) | .25 | 1.00 | .56 | .29 | .00 | .89 | .50 | .87 | 1.00 | .71 | .75 |
| LITERATURE | (800-899) | 1.00 | .30 | .56 | .55 | .00 | .87 | .00 | .93 | .60 | .29 | .71 |
| HISTORY | (900-999) | .75 | .73 | .71 | .54 | .80 | .81 | .80 | .88 | .81 | .71 | .79 |
| BIOGRAPHY | (920-929) | .82 | .71 | .68 | .40 | .65 | .82 | .25 | .97 | .89 | .75 | .79 |
| TOTAL/LIBRARY | | .77 | .80 | .64 | .53 | .67 | .79 | .64 | .96 | .77 | .77 | .76 |

Table 3.7: Probability of Availability Given Ownership




E entry activity
R reserve
F forward unsatisfied requests
D send document

Figure 3.4 Model of Resource Library Intralibrary Processing

| Resource Library | Satisfied Requests Avg. | Std.Dev. | N | Unsatisfied Requests Avg. | Std.Dev. | N |
|---|---|---|---|---|---|---|
| OPS | 7.83 | 5.20 | 856 | 7.96 | 8.70 | 462 |
| PFS | 6.15 | 4.35 | 499 | 4.80 | 3.93 | 127 |
| SLS | 1.41 | 7.48 | 347 | 0.50 | 0 | 4 |
| HAS | 6.13 | 4.93 | 270 | 4.81 | 1.54 | 16 |
| EHS | 6.39 | 5.70 | 176 | 5.22 | 5.29 | 87 |
| UOI | 5.54 | 5.62 | 161 | 16.76 | 27.82 | 39 |
| DOS | 9.87 | 8.91 | 133 | 14.79 | 25.24 | 41 |
| ESS | 6.25 | 5.08 | 162 | 8.58 | 10.52 | 12 |
| OSR | 12.30 | 23.61 | 130 | 9.54 | 14.42 | 23 |
| OLS | 8.43 | 18.52 | 100 | 5.62 | 3.21 | 33 |
| DGS | 9.38 | 9.32 | 67 | 7.56 | 7.13 | 62 |
| GSU | 9.91 | 13.50 | 93 | 7.39 | 6.87 | 36 |
| EPS | 16.71 | 21.32 | 107 | 26.75 | 19.48 | 8 |
| NLS | 7.72 | 17.19 | 76 | 4.97 | 1.88 | 15 |
| RCO | 12.31 | 5.61 | 64 | 16.20 | 14.43 | 20 |
| ARV | 15.35 | 18.93 | 71 | 0 | 0 | 0 |
| OSL | 21.26 | 12.73 | 51 | 28.50 | 16.83 | 12 |
| ISL | 15.37 | 18.00 | 23 | 55.81 | 40.57 | 16 |
| OTI | 16.29 | 14.10 | 28 | 27.17 | 32.20 | 6 |
| INT | 8.14 | 3.14 | 11 | 2.00 | 2.12 | 2 |
| Overall | 7.72 | 10.50 | 3425 | 9.15 | 13.97 | 1021 |

Table 3.8a Resource Library Processing Time for Owned and Non-Reserve Requests (Days)

| Resource Library | Satisfied Requests Avg. | Std.dev. | N | Unsatisfied Requests Avg. | Std.Dev. | N |
|---|---|---|---|---|---|---|
| ISL | 8.42 | 12.72 | 463 | 29.50 | 39.51 | 21 |
| SLS | 50.08 | 43.63 | 313 | 65.87 | 12.40 | 19 |
| UOI | 4.66 | 3.37 | 173 | 3.94 | 3.20 | 18 |
| OPS | 21.37 | 20.71 | 151 | 30.83 | 31.90 | 6 |
| OLS | 19.36 | 15.36 | 125 | 24.50 | 26.53 | 5 |
| HAS | 20.94 | 18.15 | 81 | 9.50 | 0 | 1 |
| PFS | 19.28 | 17.24 | 74 | 37.00 | 35.46 | 4 |
| EHS | 17.46 | 15.37 | 67 | 17.93 | 23.82 | 7 |
| INT | 11.42 | 14.66 | 72 | 0 | 0 | 0 |
| ARV | 59.61 | 37.32 | 65 | 62.50 | 0 | 1 |
| RCO | 12.40 | 3.43 | 48 | 14.07 | 17.76 | 7 |
| DGS | 38.13 | 28.93 | 46 | 5.50 | 1.41 | 2 |
| DOS | 34.05 | 30.14 | 42 | 16.83 | 8.39 | 3 |
| OSR | 17.12 | 16.00 | 37 | 11.64 | 11.87 | 7 |
| NLS | 15.63 | 20.96 | 15 | 5.21 | 4.11 | 7 |
| ESS | 11.43 | 13.35 | 15 | 0 | 0 | 0 |
| EPS | 16.04 | 11.66 | 13 | 28.50 | 0 | 1 |
| OTI | 67.14 | 41.75 | 11 | 0 | 0 | 0 |
| GSU | 63.50 | 0 | 1 | 0 | 0 | 0 |
| OSL | 11.50 | 0 | 1 | 0 | 0 | 0 |
| Overall | 22.54 | 29.54 | 1813 | 26.62 | 30.53 | 109 |

Table 3.8b Resource Library Processing Time for Owned and Reserve Requests (Days)

Analyzing the data in Tables 3.8a and b (with Students' t-test at the .05 significance level) reveals that there is no significant difference between processing times for reserve and on-shelf items for the following resource libraries: ESS, EPS, NLS, INT, ISL, UOI, RCO, OSR, OSL. This implies that the waiting times are unaffected by the reserve activity. Thus, for these 9 libraries, the transition probabilities associated with these libraries for the reserve activity will be defined as 0.0. The reserve request processing times in Table 3.8 are not useful for these 9 libraries and thus, there is no data available to estimate the reserve activity for these libraries.

Processing time estimates for resource libraries and the intralibrary processing activities are indicated in Table 3.9. The forward and send document nodes times for the 9 libraries without the reserve activity are obtained by aggregating the data for reserve and on-shelf requests. The forward and send document node times for the remaining libraries are obtained from the data based on the average processing time for non-reserve requests. Estimates for the reserve activity, for the appropriate resource libraries, are based on weighted averages of the processing times for satisfied and unsatisfied requests which encounter the reserve activity. From Table 3.9, we find that a request filled by SLS as a non-reserve item requires an average of 1.41 days. The reserve activity consumes an average of 49.23 days and a satisfied reserve request would thus require an average of 50.64 days to complete (i.e., 49.23 + 1.41 = 50.64). The data in this table indicates that the SLS member libraries have similar

reserve policies because they consistently require about 2 weeks processing time (with the exception of SLS ILL).

| Resource Library | PROCESSING ACTIVITY Reserve | Forward | Send Doc. |
|---|---|---|---|
| ARV | 44.26 | * | 15.35 |
| DGS | 16.37 | 7.56 | 9.38 |
| DOS | 19.37 | 14.79 | 9.87 |
| EHS | 11.53 | 5.22 | 6.39 |
| EPS | * | 26.94 | 16.16 |
| ESS | * | 8.58 | 6.69 |
| GSU | 53.59 | 7.39 | 9.91 |
| HAS | 14.34 | 4.81 | 6.13 |
| INT | * | 2.00 | 10.99 |
| ISL | * | 40.88 | 8.75 |
| NLS | * | 5.05 | 9.02 |
| OLS | 12.08 | 5.62 | 8.43 |
| OPS | 16.50 | 7.96 | 7.83 |
| OSL | * | 28.50 | 21.07 |
| OTI | 50.85 | 27.17 | 16.29 |
| PFS | 16.68 | 4.80 | 6.15 |
| RCO | * | 15.65 | 12.35 |
| SLS | 49.23 | 0.50 | 1.4 |
| UOI | * | 12.71 | 5.08 |
| OSR | * | 10.03 | 13.36 |

* = no data available

Table 3.9 Time Estimates for Resource Library Processing Activities (Days)

In addition to the intralibrary processing times for resource libraries, the model requires the transition probabilities between activities. Transition probabilities between processing activities for each resource library are indicated in Table 3.10. Note that transitions to and from the reserve activity for the 9 resource libraries mentioned earlier are undefined. The data in Table 3.10 were based on resource library processing of requests known to be owned when sent from SLS ILL. In other words, the items were searched and found in a

data base. From Table 3.10, we find that there is a 50% probability that requests processed by SLS as a resource library will be satisfied. Requests at SLS which encounter the reserve activity will be satisfied 90% of the time.

| Resource Library | Enter-Reserve | Enter-Document | Enter-Forward | Reserve-Document | Reserve-Forward |
|---|---|---|---|---|---|
| ARV | .554 | .440 | .006 | .707 | .294 |
| DGS | .255 | .367 | .378 | .958 | .042 |
| DOS | .204 | .596 | .200 | .913 | .087 |
| EHS | .219 | .510 | .271 | .882 | .118 |
| EPS | * | .903 | .047 | * | * |
| ESS | * | .932 | .068 | * | * |
| GSU | .007 | .660 | .333 | 1.0 | * |
| HAS | .219 | .730 | .051 | .988 | .012 |
| INT | * | .619 | .381 | * | * |
| ISL | * | .845 | .155 | * | * |
| NLS | * | .782 | .219 | * | * |
| OLS | .466 | .373 | .161 | .962 | .039 |
| OPS | .104 | .558 | .339 | .944 | .056 |
| OSL | * | .473 | .527 | * | * |
| OTI | .191 | .476 | .333 | .917 | .083 |
| PFS | .109 | .702 | .189 | .949 | .051 |
| RCO | * | .659 | .341 | * | * |
| SLS | .489 | .503 | .008 | .901 | .099 |
| UOI | * | .767 | .233 | * | * |
| OSR | * | .793 | .207 | * | * |

* = no data available

Table 3.10 Requests Processed Within Resource Libraries - Probability of Requests Transitioning Between Processing Activities

In summary, we have described two models for intralibrary processing which capture the significant processes encountered at SLS ILL and the resource libraries in the network. More detail is available for the SLS ILL intralibrary model because data collection focused on SLS ILL activities. Nine processing activities were used to formulate the SLS internal model which

predicts internal processing time for any request with less than 1% error.

For statistical purposes, resource libraries were aggregated from the original 61 to 20 resource libraries. Four internal processing activities were used to construct the model of resource library processing. The reserve process was found to be a significant activity for some of the libraries and thus was included in the model for those libraries. Estimates of the reserve activity were based on weighted average processing times from the data. Processing times for non-reserve requests were obtained directly from the data.

Because resource libraries very rarely receive requests for unowned items (approximately 8% of the requests received are unowned) we assumed that the probability of ownership for resource libraries is 1.0 for all requests. Thus, the internal model for resource libraries omits the search and verification activities since requests received have a known location. Before requests are routed or received by a particular resource library, probability of ownership given a search of a data base could be a useful parameter to the model in considering routing policy formulations. Thus, we have calculated probabiity of ownership for two different functions. Probability of availability at each resource library was calculated from the data by looking at the number of requests satisfied given the requests were owned and received by the resource library. We have thus estimated the parameters to the model and will discuss routing policies in the next chapter.

# Chapter Four

# POLICY ANALYSES

## The Issues

As noted in earlier chapters, in choosing routing policies for interlibrary loan networks one is interested in:

1. Maximizing the probability that a request is satisfied (P),

2. Minimizing the average waiting time, including delivery time, from initiation of a request until receipt of the desired item by the requestor (W),

3. Minimizing the average cost of satisfying a request (C).

Unfortunately, one cannot usually achieve these three objectives and a compromise is necessary. Such compromises are also called tradeoffs. Before pursuing specific analyses of routing policies and subsequent tradeoffs for SLS, we will discuss a few general issues.

Consider how one might maximize P. One approach would be to send all requests to the strongest resource library in the network. Of course, one library may not be the strongest in every request class and thus, using this policy might quite possibly result in several resource libraries being utilized. However, the general principle does not really depend on how many

strong resource libraries exist.

This "strength" policy might be an appropriate request routing policy from the point of view of maximizing P. However, it might not be very good in terms of W. Large resource libraries can be very decentralized and departmentalized which can lead to long turnaround times. Further, resource libraries that are remote from requesting libraries can have long delivery times. Thus, strength policies may result in unacceptable values of W.

Perhaps we should try to minimize W. One approach to this type of policy is to send requests to resource libraries that have short turnaround times and/or short delivery times. Requests that are satisfied in the early stages of routes based on such a "time" policy are likely to have low values of W. However, if the resource libraries utilized with a time policy have low probabilities of success, some requests may experience very large values of W because they remain in the network, seeking satisfaction, for quite awhile.

Of course, yet another approach is to try to minimize C. However, since the cost of providing the interlibrary loan service at SLS ILL is provided by state monies and is not directly related to demand for services, we will not analyze costs in this case study. In other words, while the costs are reimbursed on a per request basis, the Library Systems are budgeted in a manner that only indirectly relates to the number of requests received. Thus, reimbursement per request is not as

relevant for Systems as for Centers. On the other hand, if we were interested in processing costs rather than reimbursement costs, then an analysis of such costs would be relevant. For our purposes it is probably reasonable to assume that processing costs are directly related to processing time.

From the above discussion, it should be apparent that the strength and time policies are deficient in that they each ignore one or more aspects of network performance. What we need is some way of combining our performance measures. We have chosen to define a "requestor's benefit-to-cost ratio" as follows.

The benefit that a requestor receives from the intralibrary loan process is the use of a desired item. Thus, we can define the probability of success as a measure of the benefit received. On the other hand, the cost of the interlibrary loan process (from the requestor's perspective) is the time that must be endured waiting for the desired item. Therefore, we can define the average turnaround time as a measure of the cost incurred.

Note that we have not considered the cost in terms of dollars in our benefit-to-cost ratio. We certainly could have considered such costs. However, from a requestor's point of view, we feel that dollar costs usually do not enter into his perception of benefits and costs. Quite often there is no direct dollar cost to the requestor. Or, if there are costs, the requestor's organization may pay them for him. Or, if the requestor must pay the dollar costs himself, they are usually quite nominal.

Now, we will be much more specific in our definition of benefit-to-cost ratio. Namely, we will define the following:

$$V_{ijk} = \frac{p_{ij}}{p_{ij}\,(\hat{w}_{ij}+t_{ijk}) + (1-p_{ij})\,\tilde{w}_{ij}}$$

where

$V_{ijk}$ = value (benefit-to-cost ratio) of resource library i for class j requests from requesting library k, given that the item is owned and received by library i,

$p_{ij}$ = probability that resource library i will satisfy a class j request, given that the item is owned and received by library i,

$\hat{w}_{ij}$ = average processing time for class j requests satisfied at resource library i, given that the item is owned and received by library i,

$\tilde{w}_{ij}$ = average processing time for class j requests unsuccessfully processed at resource library i, given that the item is owned and received by library i.

$t_{ijk}$ = average time to deliver a class j request from resource library i to requesting library k.

The numerator of the benefit-to-cost ratio is quite straightforward, the denominator deserves a little discussion. The term to the left of the plus sign is the probability of success times the average time to successfully process the request and deliver the item. The term to the right of the plus sign is the probability of failure times the average time to unsuccessfully process the request. The sum of the two terms (i.e., the denominator in the equation) represents the average time for the requestor to obtain some kind of result from the resource library of interest.

To illustrate the usefulness of $V_{ijk}$, consider a requesting library C which must decide where to send a fiction request, for example. Assume for simplicity that there are only 2 possible resource libraries in the network. Library A has a relatively high probability of satisfying fiction requests, .90 for example, and poor turnaround time, e.g., 10 days. Library B has very good turnaround time, 2 days but a relatively low probability of success for fiction requests, e.g., .40. While the librarian at Library C is aware of the tradeoffs in service when comparing these libraries, it is not clear how one should "rate" the service from Library A and Library B. The definition of $V_{ijk}$ is an attempt to objectively quantify service in terms of what a requestor might reasonably expect.

$V_{ijk}$ can be used to determine routing vectors by ordering prospective resource libraries by decreasing $V_{ijk}$ and then, assigning the elements of the routing vector $r_{jk}$, j j=1,2,... J; k=1,2,...,K; in the order that results. Using the routing vectors that result, one can then employ the library network model to predict P and W as well as breakdowns along the various dimensions of the network (e.g., by request class). If W is too high, one can reduce the number of resource libraries queried.

To conclude this section, the policy analyses discussed in this chapter are all based on routing vectors derived from the "value" or benefit-to-cost ratio approach discussed here. However, we want to emphasize the fact that this is only an approach (and not the approach) to policy formulation possible

with the library network model. Future users of the model may come up with new and innovative approaches to this issue of policy formulation. And, the model should be useful in analyzing the impact of such alternative approaches to tradeoffs among multiple performance measures.

Current Performance and Policies at SLS

Before attempting to devise new request routing alternatives for SLS, it is useful to consider the network performance experienced in SLS during March 1978. The performance components are summarized in Table 4.1.

| | | |
|---|---|---|
| N | (number of unique requests) | 6,567 |
| $N_s$ | (number of requests satisfied) | 5,910 |
| P | (probability of satisfaction) | 0.90 |
| W | (average turnaround time, days) | 24.1 |

Table 4.1 Performance Measures for SLS for March 1978

These measures will serve as a baseline against which to compare the predicted performance of alternative policies which we will discuss later.

Now let us describe the request routing policies which produced the results in Table 4.1. The primary goal is to satisfy a request from System resources before going outside the System to UOI, ISL, OTI, for example. The typical order of routing requests may look like the following (see Appendix A for a detailed description):

1. SLS
2. OPS or PFS
3. other Cluster data base libraries
4. other SLS member libraries
5. ISL
6. other Interconnect libraries
7. UOI, SIU, CPL, other R and R libraries
8. other Illinois libraries
9. other libraries outside the state

Having estimated the parameters of the model (see Chapter Three), it is now relatively easy to define alternative routing policies and compare predicted network performance measures with the baseline measures of Table 4.1. Quite simply, we will try to identify a policy, or alternative policies, which decreases overall network turnaround time. Probability of satisfaction will not increase unless we introduce additional resource libraries to the network with resources which meet the needs of the current unsatisfied requests. Thus, our comparisons of alternative policies will be based on network turnaround time and possible implications for SLS ILL.

Alternative Policies for SLS

Three possible sets of policies are explored. For each policy we must define the criterion which identifies the candidate resource libraries for routing and then, define the criterion which specifies the order of resource libraries in the

route. Thus, for policy 1 (ownership policy) the criterion for considering a resource library will be a function of probability of ownership. The routing criterion, or benefit-to-cost ratio, will utilize probability of availability and waiting time. Similarly the criterion for considering resource libraries for policies 2 and 3 (availability policies) will be a function of probability of availability given ownership, with the benefit-to-cost ratio utilizing only the waiting time. Thus, with policy 1, the candidate libraries are identified as those libraries which own the item, and probability of availability and waiting time will be used as the criterion for specifying the order of the libraries in the route. With policies 2 and 3, resource libraries are first identified as owning the item and having it available for loan. In this set of policies the benefit-to-cost ratio utilizes waiting time only because all candidate libraries will satisfy the requests.

To summarize, one criterion enables us to identify the candidate resource libraries for a routing policy, while the benefit-to-cost ratio is used to order the resource libraries in the route. Constraints are also utilized to further refine the order of specific resource libraries as determined by some other management policies, such as accessing Headquarters Libraries before other member libraries. The specific combinations of routing criterion, benefit-to-cost ratio, and constraints on policies are used to identify alternative routing policies for which the model predicts network performance measures.

In creating alternative routing policies we also need to generate corresponding transition probabilities for the SLS ILL internal model of Table 3.4, and for the resource library intralibrary model of Table 3.9. These tables in Chapter Three reflect the "status quo" internal procedures. Analysis of the data with respect to referral (or routing) and probability of satisfaction indicate that probability of satisfaction does not significantly increase or decrease with referred requests. (Roughly 79% of the referred requests were satisfied and roughly 75% of the requests were satisfied by the first resource library.) Therefore, the transition probabilities of Table 3.9 for the resource libraries were determined by looking at all requests received and owned by each resource library, regardless of whether or not the resource library was the first and only resource library, or last in the referral route. These transition probabilities found in Tables 3.4 and 3.9 are broken down by class and used to represent the internal models when running the ownership policy. Thus, with policy 1, requests received by resource libraries are a function of probability of ownership and waiting time. Requests leaving the resource libraries may be either satisfied or unsatisfied.

With the second policy, the availability policy, we are interested in looking at the impact of availability information on network performance. Transition probabilities were determined for SLS ILL and the resource libraries by looking at requests owned and received at resource library i and satisfied by resource library i. Thus, with policy 2, requests received by

resource libraries are a function of probability of satisfaction[1] and waiting time. Requests leaving the resource libraries are always satisfied because the requests are only routed to libraries where the item is known to be available.

The third policy was designed to investigate the impact of SLS ILL's reserve and purchase procedures on network performance. Transition probabilities for SLS ILL were determined to reflect the referral of those requests placed on reserve, hold or purchase to resource libraries with on-shelf locations for the same item. Corresponding changes in the transition probabilities for resource libraries were also made to reflect the receipt of additional requests previously processed by SLS ILL. Because this policy does not allow SLS ILL to purchase or reserve requests found on-shelf elsewhere, the transition probabilities from $S_B$ to R, $S_V$ to R, $S_B$ to $S_P+D_P$, $S_V$ to $S_P+D_P$, and $S_P+D_P$ to P will all decrease, while the transitions reflecting the forward activities will increase i.e., $S_B$ to $S_F$, $S_V$ to $S_F$, and $S_F$ to F. The transition probabilities for the resource libraries will not differ from those for policy 2, but because we are decreasing the number of requests processed by SLS ILL, we will expect an increase in the overall network processing load.

[1]Our calculation for probability of satisfaction was calculated by empirical evidence of satisfaction and not on-shelf status because on-shelf status does not guarantee that the item will be received by the patron. Further, for a request to be satisfied by a library it must be owned and available at that library. Ownership is based on location information in the data base and, as just stated, availability is based on empirical data.

Thus, like policy 2, requests received in policy 3 by resource libraries are a function of probability of satisfaction and waiting time. Requests leaving the resource libraries are always satisfied, because the requests are only routed to libraries where the item is known to be available. Unlike policy 2, policy 3 will not allow SLS ILL to reserve or purchase requests known to be on-shelf at another location.

We now know how to establish routing policies which first identify candidate libraries on the basis of either probability of ownership or satisfaction and then, order the resource libraries in a route according to the value obtained from the benefit-to-cost ratio. The combination of criteria can be summarized for each policy:

1. candidate libraries ranked by probability of ownership, ordered by probability of availability and waiting time

2. candidate libraries ranked by probability of availability, ordered by waiting time only

3. avoiding the purchase/reserve procedures at SLS ILL when on-shelf locations are found elsewhere (i.e., forward these requests to libraries where the item is available); candidate libraries ranked by probability of availability, ordered by waiting time only.

Once the order for resource libraries is established by the benefit-to-cost ratio, we can then apply constraints to the routing criterion. We can identify four alternative constraints

for each of the three routing criteria, thus generating 12 alternative routing policies with which to compare the baseline measures in Table 4.1. The following constraints are applied to each of the routing policy criterion:

1. SLS must occur first in the route, then other libraries follow
2. SLS must occur first, then System libraries, then other libraries follow
3. SLS must occur first, plus OPS must be second, PFS must be third in the route, System libraries, then other libraries follow
4. all of the above, plus Interconnect libraries must follow System libraries, then R and R libraries, then remaining libraries.

The fourth constraint on policy 1 resembles the status quo routing policy of SLS, with the exception that the re-routes have not been included. If we subtract the average re-route time at SLS for each request we find that the average processing time for satisfied requests is 22.98 days instead of 24.14 days which includes the re-route processing time. In addition to network probability of satisfaction and overall average waiting time, the model will also predict the average number of transactions processed by the resource libraries in the network, rather than the number of unique requests. Network load is estimated from the data collected in March 1978 and thus reflects network load related to daily network demand. The actual processing load on

network libraries is larger than our predictions estimate due to the requests which were processed during the study period that originated prior to March 1, 1978. Since these requests were not included in this study, the predictions of overall network load are conservative estimates. Table 4.2 includes the predictions of overall network performance measures for the 12 alternative routing policies. Probability of satisfaction is predicted to be .94 which is the same for all alternatives in Table 4.2.

| | ROUTING CRITERION | | |
|---|---|---|---|
| CONSTRAINTS ON POLICY | OWNERSHIP | AVAILABILITY | AVAILABILITY WITHOUT RESERVES OR PURCHASES AT SLS |
| 1. SLS must be first | | | |
| avg. waiting time (days) | 20.9 | 19.6 | 14.8 |
| avg. network load (trans.) | 562.8 | 510.7 | 534.4 |
| 2. Plus System libraries | | | |
| avg. waiting time (days) | 21.8 | 20.7 | 16.1 |
| avg. network load (trans.) | 566.1 | 510.7 | 534.4 |
| 3. Plus OPS, PFS, System libs. | | | |
| avg. waiting time (days) | 22.6 | 21.1 | 16.6 |
| avg. network load (trans.) | 582.5 | 510.7 | 534.4 |
| 4. Plus Interconnect, R and R | | | |
| avg. waiting time (days) | 22.6 | 21.2 | 16.6 |
| avg. network load (trans.) | 582.7 | 510.7 | 534.4 |
| (status quo policy) | | | |

Table 4.2 Alternative Routing Policies and Predictions of Network Performance Measures

Comparing the current network measures with the ownership policy and constraint 4 reveals that the model accurately captures the operating policies of SLS. From empirical data we found overall network processing time to be an average of 22.98 days and probability of satisfaction to be .90. Using the

ownership policy and constraint 4 with the model we obtain optimal network performance measures of 22.6 days for turnaround time, and .94 probability of satisfaction. It is interesting to note that SLS ILL is experiencing close to optimal performance utilizing their current routing policy. The prediction of .94 is larger than SLS's current probability of satisfaction, because we allowed a route to contain 20 (or all) resource libraries. Since SLS rarely includes more than 5 resource libraries in a route, this would explain the slightly lower probability of satisfaction experienced in the network. As mentioned earlier, the predicted daily processing load on the network, 582.7 transactions, is conservative, because our sample did not include requests initiated before March 1 and after March 31.

Let us first consider the general impact of the three routing criterion and then consider the impact of the constraints on the policy a little later. Comparing the ownership policy with the availability policy we find a decrease in average processing load and a corresponding decrease in turnaround time. Since the availability routing criterion is defined as sending requests to resource libraries which own the items and have the items on-shelf, resource libraries will never receive requests which they cannot satisfy. Thus, we should expect some decrease in processing load and average turnaround time with the implementation of the availability routing criterion.

In fact, the availability criterion and the constraint of SLS first results in a decrease of 13.3% (19.6 days) in network turnaround time when compared to status quo performance.[1] The 12.4% decrease in processing load is based on the overall network load. The decrease predicted for resource libraries other than SLS ILL is actually a 24.2% reduction in processing load for those libraries when SLS uses the probability of availability as the criterion for identifying candidate libraries.

The third routing criterion also utilizes probability of availability for identifying candidate libraries, but has the effect of forwarding additional requests to resource libraries in the network. The goal of this criterion is to reduce network turnaround time by avoiding the reserve and purchase procedures at SLS ILL when possible. More specifically, if a reserve or purchase request at SLS ILL were found to be on-shelf elsewhere, the model would analyze those requests as if they were processed by the resource library where the item was available. (From the empirical data we found that 26% of the reserves at SLS ILL and 12% of the purchases at SLS ILL had on-shelf locations elsewhere, most of which would probably have been available had they been requested.) Comparing the availability criterion with the availability without reserves or purchases at SLS criterion, we find a decrease in turnaround time and an expected increase in Network processing load.

[1] All of our comparisons were made with the status quo performance predicted in Table 4.2, i.e., ownership policy and constraint 4.

By avoiding the current purchase and reserve policies at SLS ILL for items found on-shelf elsewhere, the model predicts 34.5% reduction in network turnaround time and 8.3% reduction in processing load. Resource libraries other than SLS ILL would experience a 16.3% reduction in processing load. While SLS ILL may decide to purchase items found on-shelf at other libraries, the overall network turnaround time could be reduced significantly if SLS ILL forwarded those requests to resource libraries with the available item.

Referring to constraint 1 in Table 4.2, we should also note that this constraint implies that SLS ILL may access resources outside the System before exhausting member libraries. Constraint 4 is close to the current constraints employed by SLS ILL and does not drastically reduce the improvement predicted with the other constraints. With constraint 4, we have the same processing load performance as with the other constraints, while for the availability policy without reserves or purchases the network turnaround time is reduced by 28.8% instead of the 34.5% predicted with constraint 1. Thus, we find that if SLS ILL maintains its current constraints on ordering resource libraries in the route and avoids the reserve/purchase procedures for on-shelf items located at other libraries, they can expect a decrease in average network turnaround time as well as a decrease in overall network processing load.

# Chapter Five

## RECOMMENDATIONS AND CONCLUSIONS

In general, we found that the current routing policies employed by SLS are resulting in close to the optimal performance measures predicted by the model. With the exception of a few refinements, the current routing policies of SLS are quite acceptable in terms of satisfying requests. On the other hand, some activities in SLS such as verification, reserve, and purchase consume significant amounts of time and perhaps improvements can be made in these areas.

The results of this study are summarized in four recommendations as well as a brief summary of some of the interesting empirical findings and estimates established for the internal model. Our analysis shows that SLS ILL is currently experiencing network performance measures close to optimal performance. Given the current routing policy implemented by SLS ILL, the network experiences an average of 24.14 days to satisfy requests and the overall probability of satisfaction is .90. If SLS ILL were willing to loosen constraints on the routing order of resource libraries and avoid the purchase/reserve procedures for items found on-shelf elsewhere, they could expect a decrease in average network turnaround time of 34.5%, and a reduction in the network processing load of 8.3%. However, we also found that maintaining current constraints (constraint 4 in Table 4.2) while avoiding the purchase/reserve procedures for on-shelf items found elsewhere will result in quite respectable improvements, namely a

28.8% reduction in network turnaround time with the same processing load reduction found for constraint 1. We should note that the estimate for reduced turnaround time is based on identifying resource libraries with on-shelf locations for the desired items. In other words, all candidate libraries have circulation status information for desired items. With the expansion of CLSI in ILLINET and future plans to coordinate LCS and CLSI, it will be possible for SLS to identify on-shelf locations for a large percent of the possible resource libraries in the network.

The next recommendation is that availabilty information reduces network processing time and load. In order for the network to benefit from this technology, the entire network must participate in providing on-shelf location information and further, must allow SLS to place a hold on items found in this manner. While SLS member libraries might feel a loss of autonomy over their local collections by providing on-shelf status, they would benefit from a 24.20% reduction in processing load because the network would require fewer processings per request.

The third recommendation relates to re-route requests. We found that a 5% reduction (1.16 days) in waiting time for satisfied requests can be achieved if SLS ILL were able to avoid the re-route process for on-shelf items. Of course, this implies that suitable automatic routing procedures would have to be developed within SLS.

Finally, one can order the search of data bases in terms of decreasing probability of ownership, given a search of the data base. We found that a slight change in the current order should enable SLS ILL to identify locations with fewer data bases per request than their current policy. We basically recommend searching the MACs before the Interconnect data bases. One might argue against this recommendation, because seeking availability information (i.e., the Interconnect data bases) is considered more beneficial than reducing the number of data bases searched per request, especially since CLSI searching probably requires less than a few minutes per request.

Some of the empirical findings are also interesting to summarize. SLS ILL currently experiences a .90 probability of satisfying requests. Given a search of the CLSI data bases, SLS can expect to find 57% of the requests searched to be on-shelf. Of the on-shelf items found in a CLSI search, 76% of the items will be satisfied by the library contacted with on-shelf status. The average waiting time at any one resource library in the network is 14.25 days while the average time to satisfy a request is 24.14 days. At SLS ILL non-purchase/reserve requests are satisfied in 1.14 days and unsatisfied requests in 0.50 days. Requests purchased by SLS ILL require an average of 67.17 days to complete, 46.15 days for satisfied requests and 100.32 days for unsatisfied requests. Requests cancelled without routing require an average of 47.47 days.

These measures of processing time for SLS ILL are averages based on the empirical findings. More refined estimates of individual processing activities were obtained by developing a model of the internal processes at SLS ILL. Significant internal processes were identified in Figure 3.3 and the estimates of time to complete these separate processing activities are indicated in Table 3.3. Based on these estimates, we can say that SLS ILL requires 1.17 days to locate an item found in their collection and on-shelf. Requests placed on reserve or hold at SLS experience an average of 50.31 days in the reserve activity. The purchase activity alone was found to require an average of 46.50 days.

In summary, we have found that SLS's current routing policy results in performance very close to the optimal performance measures predicted by the model. By loosening some of the constraints on routing order and forwarding reserve/purchase requests to libraries with on-shelf locations, SLS will experience improvements in network turnaround time and processing load.

# APPENDIX A:
# SLS ILL PROCEDURES

The purpose of this Appendix is to supplement the second section of Chapter Two, SLS ILL Internal Processing, with the detailed procedures encountered by the majority of requests processed by SLS ILL. We will consider periodical and census microfilm requests later and first describe the internal procedures related to book requests.

## Book Request Procedures

### 1. SLS CLSI Cluster Data Bases/Union Catalog

As new book requests are received they are searched through the SLS Cluster data bases in a fixed sequence:

1. OPS data base,
2. PFS data base,
3. EHS data base,
4. OLS data base.

All requests except those found on-shelf or circulating at SLS must be searched through the OPS and PFS data bases which contain the holdings of the two Headquarters Libraries.

After searching the OPS data base a request may be located at SLS. If the item at SLS is on order, missing from the shelf, or it is a reference book which cannot be circulated, the request will continue to be searched in the second data base, PFS. These

requests, together with requests not found in OPS or found in libraries other than SLS, are then searched in the PFS data base.

The significant outcomes for a book found in the SLS collection are the following:

1. book is obtained, and delivered to requesting library,
2. book is circulating, a hold placed on CLSI and eventually delivered to requesting library,
3. continue searching of the PFS data base for books on order, missing from the shelf, or non-circulating reference books.

In the case of a circulating book, the searcher enters the "placeahold" procedure on CLSI which indicates the number of reserves or holds for each circulating copy. Additional copies of a book will be purchased at SLS when the number of holds exceeds 4. When the requested item is a reference book the ILL librarian will be notified for a decision regarding special circulating status.

In some unusual cases the demand for a book far exceeds the number of copies, i.e., a patron may be the 5th, 6th,---etc. person placed in the queue to receive the book. Purchase of additional copies is generally made with the goal that the new purchase will arrive to alleviate the long queues. However, the status of purchases is not checked by SLS staff. It is possible that the patron may experience rather long waiting times for very

popular books for which insufficient copies are owned by SLS.

All requests except those found on-shelf or in circulation at SLS, are searched through both OPS and PFS data bases (which contain holdings of the Headquarters Libraries) before being routed to any resource library. Requests are routed at this point if at least one on-shelf location exists. If there are on-shelf locations at both Headquarters and non-Headquarters libraries, the request is sent to the Headquarters Library first. SLS will first seek on-shelf locations for books and avoid placing reserves until all 4 data bases have been searched. Generally speaking, all requests have been searched through 2-4 data bases by 10:00 a.m. the morning following initial receipt. If on-shelf locations have been found, the requests have been routed to a potential resource library.

For any request routed to the SLS member resource libraries, a request notice is delivered daily by van. After receipt of this notice to the resource library the following alternatives may occur:

1. book is delivered by van to the requesting library, and SLS ILL receives a circulation notice;
2. book was circulating by the time the request notice was received and a reserve notice was delivered to both SLS and the requesting library;
3. book was unavailable for some reason, no reserve was placed by the resource library, and the request was returned to SLS as a re-route request.

For re-route requests, searching is continued at the appropriate point, depending on their record of previous searching.

We will now consider those requests which have been searched through the 4th data base and have not yet been routed to a resource library. For those requests which were located in the data bases but circulating at all locations, the searcher will try to identify a potential resource library. The searcher engages in an iterative process whereby the placeahold procedure for each possible resource library is initiated until a location is found with less than 3 holds per copy. If all possible locations are found with 3 or more holds per copy, SLS ILL will initiate purchase procedures for the item. The requesting library is notified through a status report that an attempt was made to purchase the item.

Requests not found circulating at all possible locations may be either on order at SLS, on order at other locations, or not found in any of the SLS Cluster data bases. Any request for an item on order at SLS will be reserved for the patron at this point in the procedures. Purchase of additional copies will be considered when more than 4 holds exist for the ordered item. Requests which are found to be only on order at other locations are cancelled and no longer searched. The requesting library is notified of the order and asked to resubmit the request at a later date.

Requests searched through the SLS Union Catalog have not been found in any SLS Cluster data base. This union catalog is a card catalog which is no longer maintained for the 14 SLS member libraries represented in the Cluster data bases. However, it is the primary location tool for other SLS member libraries, e.g., Governor's State University. Any request found in the catalog which is non-reference is delivered by van to the resource library. A reference book request is brought to the attention of the ILL librarian. Based on the librarian's judgment, special permission may be requested by telephoning the potential resource library. If special circulating status is granted, the book is delivered to the requesting library. On the other hand, where the item is not allowed to circulate, the ILL librarian is notified for a decision. The request may be cancelled if the librarian decides the item is most likely part of a reference collection which is frequently in use and thus not likely to circulate from any library. On the other hand, if the particular item is likely to belong to the circulating collection of other libraries, the librarian may decide to continue searching at the second stage.

2. CLSI Interconnect Data Bases

Requests which reach the second stage, the CLSI Interconnect data bases, are either not found in any SLS resource or qualify as reference books which are likely to circulate at other resource libraries.

Searching the CLSI Interconnect data bases is scheduled and occurs in a fixed sequence:

1. Illinois State Library (ISL),
2. Northern Illinois Library System (NILS),
3. North Suburban Library System (NSLS),
4. Rolling Prairie Library System (RPLS).

Re-route requests can of course enter the second stage at any data base depending on their previous search history.

The ISL data base contains the circulation status of its own book collection. Each of the System data bases consists of one data base with a portion of its member libraries' book collection. The primary goal in searching the Interconnect data bases is to find an on-shelf location. Once an on-shelf location is found, searching stops for that request. The placeahold procedure is initiated and a request notice is sent through CLSI to the potential resource library. Either the request is satisfied and the book is delivered to SLS for processing, or the request is returned to SLS unfilled and qualifies as a re-route request. The delivery mode from ISL to SLS is mail, whereas deliveries from the Systems to SLS are by van, with the exception of RPLS which delivers by mail.

After an attempt has been made to identify an on-shelf location through all 4 data bases, and requests for which on-shelf locations were identified and routed to potential resource libraries, we are left with the following requests:

1. not found in any Interconnect data base,
2. circulating at all possible locations,

If requests in the latter category include an ISL location with no additional holds, SLS may TWX the request to ISL. ISL may decide to reserve the item or not. In the case of a reserve the book is eventually delivered to SLS by mail. When ISL decides not to reserve the book the request may either be returned unsatisfied to SLS, or it may be referred to an R and R Center Library or Special Resource Library.

Returned requests at this stage are considered by the ILL librarian and may be either cancelled, purchased, or continued searching at the third stage. For referred requests, SLS receives copies of the TWX'd referrals and thus obtains a record of the resource libraries encountered in the route. Eventually, the request is either satisfied and the book is delivered to SLS for processing, or the request is unfilled and continues searching at the third stage. For those requests which were not found in any SLS CLSI data base, or SLS Union Catalog, searching through all Interconnect data bases has occurred (or a hold placed through CLSI) within 24 hours of receipt of the initial request.

3. Verification

Requests which reach the third stage (search of various library and union catalogs) are either requests not found, or found circulating in any CLSI Interconnect data base; requests

returned unfilled from ISL because ISL chose not to reserve; or requests which were referred by ISL and unfilled by all resource libraries in the route (which may be greater than 1 but generally less than 4).

The type of request that reaches this stage in processing requires more individual attention than the previous requests which were located and routed in some way to the SLS member libraries, Interconnect libraries, or referred to the R and R Libraries. All requests which reach this stage will be searched in either IMAC or Book History depending on the recency of publication date. These tools are the printed catalog of ISL's book collection. A "MAC" is a microfilmed catalog and three of these exist: IMAC for ISL, SMAC for SIU, and UMAC for UOI.

Virtually all requests which reach this stage are searched in at least one of the ISL catalogs. If the request is not found or is returned unfilled from ISL, alternative searching may continue but there is no fixed sequence. Continued searching is determined by knowledge about the request (e.g., recency of publication, completeness of bibliogaphic information, etc.) and knowledge about the material accessed through the available verfication tools at SLS. The primary tools used to locate a potential resource library include: Book History, MACS, National Union Catalog (NUC), an OCLC search provided by ISL, and knowledge concerning characteristics about special collections in other Illinois libraries. Requests which are searched in any of these tools may result in changed bibliographic information due

to incorrect author name or spelling errors, for example. These requests are generically referred to as re-check requests because they essentially qualify as new requests requiring searching from the beginning at stage 1.

The primary goal at this stage is to identify an R and R Library or Special Resource Library location. Requests which are found in either IMAC or Book History are sent to ISL. A request satisfied by ISL results in the book delivered to SLS for processing. If the request is unfilled by ISL it may either be returned, in which case the ILL librarian will decide whether continued searching is feasible, or ISL will refer the request to an R and R Library or Special Resource Library. SLS receives copies of the TWX notices as a record of the referral route encountered by the request. Eventually the book is delivered to SLS, or the request is unfilled. The ILL librarian is notified in the case of unfilled requests for a decision to either cancel the request, initiate purchase of the item, or continue searching.

Requests which become candidates for the other search tools can be categorized by the following:

1. not found in IMAC and Book History,
2. unfilled by ISL and returned to SLS,
3. unfilled by the R and R Center Libraries or Special Resource Libraries and returned to SLS.

The particular tools chosen for searching each request are decided by the Technical Assistant (T.A.). When the T.A. has exhausted all possible verification tools and is still unable to satisfy a request, two alternatives are possible. The request may be suggested for purchase and the ILL librarian notified for a decision. Alternatively, the T.A. may decide that a request can be searched no further because, for example, it is out of print, or has incomplete bibliographic information. These requests are not suggested for purchase, but the ILL librarian is notified of their status.*

Requests which are TWX'd to UOI or SIU by SLS are either located in the respective MACs or, because the publication date is too recent to qualify for a MAC search, the requests are sent to the R and R based on the following subject guidelines:

1. for UOI, requests for all academic level publications and scientific proceedings,
2. for SIU, requests for Southeast Asian studies, parapsychology/occult sciences, science fiction,

* During August 1978, SLS ILL began using their own OCLC terminal for ILL searching. Requests originating in August 1978 were generally searched on OCLC after the Interconnect stage and before the MACs were searched. The procedures described in this Appendix do not include OCLC searching by SLS ILL because this resource was not used in March 1978. Requests which originated in March 1978 were sometimes searched on OCLC in August through October 1978 by SLS ILL. Because there were so few requests in this study that were searched by SLS ILL (6 requests), it was considered not useful to analyze this category of requests.

light fiction, and nursing literature.

A search of NUC is generally reserved for older publications. If the search results in R and R Library or Special Resource Library locations, the request is TWX'd to the appropriate R and R Library. The second alternative which may result from an NUC search is the identification of other library locations which lend books according to the National Interlibrary Loan Code of 1968. Libraries adhering to this code are discouraged from sending ILL requests out of state for books in print. Thus, in print items are requested from Illinois libraries only. If the request is satisfied, the book is delivered to SLS for processing. Unfilled requests are brought to the attention of the ILL librarian who may decide to cancel the request, purchase the item, continue searching, or re-route to other possible locations previously identified. In cases where no NUC locations are established, the T.A. may continue searching or may request a decision to cancel or purchase (if possible) from the ILL librarian.

Another verification procedure that is possible is requesting an OCLC search from ISL. This is frequently used for requests too recently published to be listed in the MAC's or for which NUC yields no locations. The following alternative outcomes are possible once ISL receives this type of request which must be verified at SLS before sending:

1. location of R and R Library or Special Resource

Library , in which case ISL refers request via TWX to R and R Library,

2. locations found in other libraries either in Illinois or out of state, and ISL returns OCLC printout to SLS,
3. no location found through OCLC, and ISL returns TWX message.

Requests not found through OCLC (as well as through previous searching) and in print will be purchased by SLS. If on the other hand the request is out of print and no locations have been identified, the ILL librarian is notified for a decision to cancel or continue searching. The remaining requests searched through OCLC have resulted in library locations and are either referred to appropriate R and R Libraries, or sent to other libraries under the National Interlibrary Loan Code.

In some cases a library may be telephoned regarding ownership of a particular request which has been previously verified at SLS. The T.A.'s knowledge about special subject strengths in other libraries in Illinois leads to the satisfaction of a relatively few requests. These libraries are approached only after R and R Library resources have been considered by the T.A. Assuming the library grants permission for interlibrary loan, a request notice will be sent according to the National Interlibrary Loan Code. Otherwise, the T.A. must continue searching appropriate tools.

In general, it is the primary responsibility of the T.A. at this stage to find a library location and request the item. If a request is returned unfilled from a resource library, the ILL librarian is notified for a decision regarding cancel, continue searching of appropriate tools, purchase, or re-route to other known locations. The T.A., however, may be unsuccessful in locating a potential resource library or verifying bibliographic information, in which case the ILL librarian will be notified for a decision.

Beginning with June 1, 1978, a new policy was instituted which utilized the SLS Information Service (SIS) at Oak Lawn Public Library. Before cancelling some author-title requests, SLS ILL may send these requests to SIS. In most cases, patrons indicated that another edition would be acceptable or they were willing to accept a substitute title. In some cases, substitute titles or editions were not mentioned but SLS ILL could not locate the title and would refer the request to SIS for further processing. These requests were always returned to SLS ILL with the final status indicated by SIS.

These procedures outlined for books pertain to new requests (which also include re-check requests where changes in bibliographic information resulted in new data) and re-route requests. Rush requests are defined as requests which are needed within than 30 days. These requests are searched with the same procedures as new requests but are searched before all others. Telephone calls are made to owning libraries with on-shelf

locations indicated by CLSI, or locations indicated by the SLS Union Catalog. If the request is located in the CLSI Cluster data bases and circulating, a hold will not be placed; rather, an exception is made to SLS's policy of not going outside the System for owned items. Thus, SLS ILL will attempt to satisfy the rush requests by going to the Interconnect data bases and various union catalogs.

Photocopy Request Procedures

Requests for photocopies of periodical articles are processed with an entirely different set of procedures. They are not searched with any computer readable data bases. Requests for an entire issue of a periodical are not loaned or photocopied by SLS ILL. Photocopy requests, unlike books, incur a charge dependent on the number of pages copied. SLS ILL subsidizes the cost of photocopies by paying for articles less than 10 pages, but the requesting patron (or library) pays for longer articles in their entirety. A request may be unfilled because the patron indicates some maximum amount of dollars he is willing to pay which is later found to be inadequate for the entire request. Thus, in some cases, unfilled requests may be due to the patron's constraint rather than unavailability of the item.

All periodical requests are searched in the SLS Union List of Serials. The main goal is to identify an Oak Park Public Library location because it contains the System-owned periodical collection (as well as its own) and SLS staff work there to process ILL requests. Once an Oak Park location is identified,

the request notice is delivered by van. No article verification is done at this point. In the case of rush periodical requests, the request notice is TWX'd from SLS ILL. If the request is satisfied, the photocopy is delivered by van to the requesting library and the filled notice is delivered to SLS ILL.

Those requests which were either not found in the SLS Union List of Serials or found but without an Oak Park location are searched in other union lists of serials. Unsatisfied requests returned to SLS ILL from Oak Park also receive continued searching of other union lists. If an Oak Park location fails, then the next goal is to identify an R and R Library. Once an R and R Library is identified, SLS ILL will attempt to verify the citation to the article (volume, issue numbers, page, etc.). The request is TWX'd to the R and R Library. A satisfied request is delivered to SLS and eventually delivered to the requesting library by van. Unfilled requests may be returned to SLS ILL or referred to other R and R Libraries. In the case of referrals, SLS receives copies of the TWX'd referrals as a record of the request route. Returned (i.e. unsatisfied) requests are considered by the ILL librarian. If the request was returned because the article could not be found in the volume cited, the request is cancelled. The librarian may decide that it is possible to identify other locations through additional union lists, or the request could receive further routing based on locations previously identified but not approached. Unsatisfied requests which exhaust the route of all possible locations are cancelled as well as those requests which are not identified in

other library locations.

Census Microfilm Procedures

A fairly straightforward procedure is used to satisfy census microfilm requests since there is essentially one resource, the U.S. Federal Archives and Records Center, Chicago Branch. Requests are sorted by completeness of information and appropriateness of subject matter. For example, requests for Canadian or U.S. state censuses are not searched in the Federal Archives catalog. These requests are given to the ILL librarian who can determine appropriate locations to send these requests. Searching the Census catalog requires a county name for access, and large city censuses require a specific ward number. Thus, requests received without this information are given to the ILL librarian who either determines the complete bibliographic identification or cancels the request.

# APPENDIX B:

## ASSUMPTIONS MADE DURING DATA ENTRY

While the majority of requests were handled straightforwardly by the data entry procedures described in Chapter Two, some requests required additional attention. This Appendix contains the detailed decisions and assumptions made about requests at the time of data entry. This description completes the background information necessary before obtaining an accurate interpretation of the data analysis. For convenience we have aggregated these assumptions under 6 categories: (1) SLS procedures, (2) reserve/hold requests, (3) Interconnect libraries, (4) OCLC searches, (5) paperback/rental copies, and (6) verification and search activities.

Included in the SLS procedures category are eleven problem areas where it was necessary to make assumptions about the data. When a request is re-routed to a SLS Cluster library or Interconnect library we assumed that a re-search of the data bases occurred before the request was sent to the next resource library in the route. While data entry did not specify the actual sequence of data bases in the re-search activity, the assumption is made that re-searching occurs until an on-shelf location is found.

A second problem arose when some requests were filled by SLS but not found in the data base. Confirmation of these requests with SLS ILL indicated that some items may not show up in the SLS CLSI data base; however, the searcher may be familiar with the

requested item and locate it alphabetically on the shelf at SLS. There were very few requests that fell into this last category.

Processing time statistics were collected to indicate internal processing time at SLS (e.g., initial processing of all requests received) and turnaround time experienced by patrons (i.e., the time interval from the receipt of the request at SLS to the final reply date to the requesting library). Because SLS ILL fulfills two roles, i.e., initial processor and a possible resource library, we may not be able to distinguish SLS, the resource library, from SLS, the initial processor, for requests which they tried to obtain from the shelf but failed and then continued searching.

In some cases, both the requesting library and resource library were indicated as SLS. A phone call to SLS ILL indicated that these requests were placed by SLS staff who wanted to borrow a book from the SLS collection.

A fifth problem related to cancelled requests. Initially SLS ILL would send to SLS Information Service requests which were cancelled without any routing. These requests were tallied as cancelled by SLS. This policy changed around June 1, 1978 and these requests were not automatically tallied as cancelled without routing because the Information Service sent the requests back to SLS ILL after processing. Thus, final status of the request might be indicated as filled rather than cancelled. The requests sent to the Information Service either required extensive reference searching or the patron indicated that

substitute editions or titles were acceptable.

Any requests satisfied by SAVS (Suburban Audio-Visual Service) were entered as SLS. A seventh group of requests were received and processed by SLS prior to March 1, 1978 but the requesting library resubmitted the request on the same request form during March. We were only interested in entering the processing activity data which occurred during the time of this case study. We had to make assumptions about the search activity and assumed the normal sequence of data base searching until an on-shelf location was found, or until the resource library was located.

In one case, we received a request for 6 copies of the same title. SLS located 5 copies and we entered the data for 6 unique requests, of which 5 were satisfied, and 1 cancelled without routing.

Toward the end of the study period, we received a group of requests without resource library identifications. After discussion with SLS ILL we decided to assume these requests were cancelled.

A tenth group of requests toward the end of the study period were filled by SLS but not owned according to the data base searching data. Again discussion with SLS ILL confirmed that a reasonable assumption could be made that these requests were purchased by SLS. And finally, some requests indicated that verification was encountered at SLS with additional bibliographic

information found; however, re-checking the data bases did not occur (which is the usual procedure) because a decision to purchase the item was made.

When a TWX form was sent to an R and R library and "reserve" was indicated on the TWX form, we assumed the item was on the shelf. However, when the TWX form was sent to ISL after searching the ISL data base, "reserve" indicated the item was found circulating. A "hold" indicated on a request form sent to an Interconnect library indicated the item was found on the shelf, while a "reserve" sent to an Interconnect library indicated the item was found circulating.

The Interconnect data bases are identified by their respective Systems or ISL. While multiple library locations are included in each Interconnect data base our data represents only one location, namely the System name or ISL. It is therefore possible that a request could be routed to multiple libraries located in NILS, for example; however, the data would indicate NILS as the resource library contacted more than once.

Data regarding OCLC searches indicate that SLS requested the search for possible resource library locations. The data does not indicate when a potential resource library provided the OCLC search without receiving the explicit request from SLS. An OCLC search was considered useful only if an attempt was made to contact a resource library located in OCLC. Some requests sent to ISL for an OCLC search were filled by ISL. The data was entered as requesting an OCLC search but useful location was not

found.

Searching the SLS Cluster data bases may result in multiple copies located at various libraries. In addition to circulating and on-shelf status, items may also be indicated as paperback or rental. In general, SLS avoids borrowing paperback or rental copies. The data was ambiguous in the case where multiple copies at one location included circulating copies, on-shelf copies, and paperback/rental. We could not determine whether or not the paperback/rental copies were circulating. We assumed the status of the item as both on the shelf and circulating and disregarded the paperback/rental status. However, if we could determine from the data that a paperback/rental copy was on the shelf, the data was entered as on the shelf - paperback/rental. Otherwise, if the paperback/rental copy was indicated as circulating, the data was entered as circulating.

The last category of problem areas relates to a fine distinction between the verification activity and the search activity when it is possible that the same search tool could be used for both purposes, such as the MACs. The primary purpose of the verification activity is to check the bibliographic information, while the primary purpose of the search activity is to locate a resource library. Both of these activities can be engaged in simultaneously, but for analytical purposes it is convenient to separate the two activities because they represent two different functions. Data regarding the search and verification activities were interpreted differently for book

requests and periodical requests. In the case of periodical requests, many of the primary search tools were also used to verify bibliographic information; whereas, in the case of book requests the primary search tools were used to locate holding libraries. The verification activity for periodical requests was assumed to be encountered if there was a change in bibliographic information, for example, after searching a MAC which resulted in a re-check of data bases. However, when no re-check of data bases occurred for periodical requests we assumed that SLS did not encounter the verification activity because the MAC was being used for location information, i.e., the search activity. We assumed book requests were verified when brackets enclosed the author-title information and an initialed verification tool was shown on the request form. Even if no change in bibliographic information resulted for book requests and no re-checking of data bases occurred, we coded these requests as having encountered verification. Obviously, if a change in bibliographic information occurred for requests we also coded the request for the verification activity.

# APPENDIX C:

## Subject Class and Publication Date Tables

The following tables provide an analysis of the raw data, i.e., monthly demand generated during March 1978 at SLS ILL by age and class. We found that 18% of the total demand (6567 requests) did not have publication date information. Thus, the tables in this appendix provide a breakdown of 5390 requests by publication date and subject class. Table C1 includes all requests with publication date, Table C2 describes the age and class distribution for photocopy or periodical requests, and Table C3 describes the distribution for monographs. We coded periodical requests explicitly from the data collection forms. In our analysis for this appendix, we assume a monograph request to be any request that is not a periodical. Thus, monographs in Table C3 cover requests which may identify sources other than monographs; however, it is assumed that the majority of requests are monographs and non-periodicals.

Publication dates range from 1978 through 1946. We decided to aggregate the pre-1946 data which represents 4.6% of the total number of requests. Aggregating these dates enables us to present more compact tables without losing the sense of the overall distribution of public library demand by age and subject class.

| REQUEST CLASS | | PUBLICATION DATE 1978 | 1977 | 1976 | 1975 | 1974 | 1973 | 1972 | 1971 | 1970 | 1969 | 1968 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FICTION | (813+823) | 104 | 288 | 151 | 74 | 59 | 31 | 37 | 43 | 20 | 19 | 27 |
| GENERAL | (001-099) | 14 | 37 | 28 | 14 | 10 | 11 | 9 | 10 | 16 | 2 | 3 |
| PHILOSOPHY | (100-299) | 10 | 42 | 13 | 17 | 14 | 13 | 16 | 8 | 7 | 10 | 12 |
| PSYCHOLOGY | (130-159) | 19 | 62 | 34 | 26 | 14 | 13 | 15 | 17 | 13 | 14 | 7 |
| SOCIAL SCI | (300-369) | 26 | 81 | 54 | 23 | 23 | 18 | 18 | 10 | 12 | 12 | 3 |
| POLTCL SCI | (320-659) | 8 | 120 | 72 | 50 | 40 | 21 | 20 | 13 | 13 | 14 | 9 |
| EDUCATION | (370-379) | 4 | 23 | 20 | 10 | 9 | 4 | 8 | 6 | 5 | 7 | 7 |
| LANGUAGE | (400-499) | 0 | 4 | 2 | 4 | 1 | 2 | 3 | 0 | 0 | 0 | 2 |
| ENG-SCI | (310-699) | 10 | 60 | 38 | 25 | 22 | 15 | 15 | 15 | 9 | 11 | 6 |
| LIFE SCI | (560-639) | 3 | 33 | 9 | 15 | 9 | 8 | 8 | 4 | 9 | 5 | 2 |
| MEDICL SCI | (610-619) | 25 | 157 | 66 | 37 | 56 | 28 | 18 | 17 | 19 | 17 | 14 |
| HOME ECON | (390-649) | 5 | 59 | 24 | 15 | 18 | 14 | 11 | 9 | 1 | 7 | 4 |
| ARTS | (700-779) | 6 | 92 | 49 | 37 | 22 | 17 | 13 | 15 | 9 | 6 | 6 |
| MUSIC | (780-789) | 2 | 9 | 7 | 4 | 12 | 4 | 6 | 5 | 5 | 1 | 4 |
| RECREATION | (790-799) | 13 | 53 | 34 | 19 | 25 | 5 | 6 | 5 | 8 | 3 | 4 |
| LITERATURE | (800-899) | 5 | 19 | 8 | 18 | 5 | 11 | 10 | 11 | 6 | 7 | 6 |
| HISTORY | (900-999) | 29 | 82 | 37 | 24 | 10 | 13 | 9 | 8 | 10 | 5 | 11 |
| BIOGRAPHY | (920-929) | 16 | 53 | 41 | 12 | 17 | 12 | 10 | 10 | 9 | 7 | 10 |
| TOTAL PER YEAR | | 299 | 1274 | 687 | 424 | 366 | 240 | 232 | 206 | 171 | 147 | 137 |

Table C.1 March 1978 Demand by Publication Date and Dewey Class
(Continued)

| REQUEST CLASS | | PUBLICATION DATE 1967 | 1966 | 1965 | 1964 | 1963 | 1962 | 1961 | 1960 | 1959 | 1958 | 1957 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FICTION | (813+823) | 26 | 13 | 14 | 10 | 7 | 9 | 9 | 13 | 4 | 13 | 9 |
| GENERAL | (001-099) | 2 | 4 | 2 | 1 | 1 | 3 | 2 | 4 | 1 | 1 | 3 |
| PHILOSOPHY | (100-299) | 5 | 5 | 3 | 11 | 3 | 2 | 2 | 2 | 3 | 2 | 5 |
| PSYCHOLOGY | (130-159) | 3 | 3 | 7 | 4 | 6 | 2 | 4 | 3 | 1 | 1 | 1 |
| SOCIAL SCI | (300-369) | 11 | 6 | 5 | 9 | 4 | 3 | 1 | 2 | 1 | 2 | 4 |
| POLTCL SCI | (320-659) | 12 | 6 | 7 | 4 | 4 | 3 | 6 | 4 | 2 | 4 | 0 |
| EDUCATION | (370-379) | 3 | 1 | 4 | 2 | 1 | 0 | 2 | 3 | 2 | 0 | 0 |
| LANGUAGE | (400-499) | 0 | 3 | 0 | 1 | 0 | 2 | 2 | 0 | 0 | 1 | 0 |
| ENG-SCI | (310-699) | 15 | 7 | 3 | 1 | 6 | 6 | 2 | 6 | 2 | 4 | 0 |
| LIFE SCI | (560-639) | 3 | 10 | 3 | 2 | 3 | 1 | 1 | 0 | 2 | 2 | 1 |
| MEDICL SCI | (610-619) | 3 | 8 | 7 | 5 | 4 | 2 | 6 | 15 | 3 | 2 | 1 |
| HOME ECON | (390-649) | 3 | 2 | 4 | 2 | 2 | 0 | 0 | 1 | 0 | 2 | 1 |
| ARTS | (700-779) | 6 | 5 | 2 | 6 | 1 | 1 | 1 | 2 | 0 | 2 | 1 |
| MUSIC | (780-789) | 2 | 2 | 1 | 2 | 0 | 2 | 4 | 0 | 0 | 0 | 1 |
| RECREATION | (790-799) | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 0 |
| LITERATURE | (800-899) | 7 | 3 | 3 | 7 | 6 | 8 | 1 | 7 | 1 | 3 | 5 |
| HISTORY | (900-999) | 7 | 12 | 4 | 5 | 3 | 7 | 3 | 10 | 3 | 2 | 1 |
| BIOGRAPHY | (920-929) | 3 | 5 | 3 | 8 | 3 | 2 | 2 | 6 | 4 | 0 | 3 |
| TOTAL PER YEAR | | 114 | 96 | 75 | 81 | 55 | 56 | 49 | 79 | 32 | 42 | 36 |

Table C.1 March 1978 Demand by Publication Date and Dewey Class
(Continued)

PUBLICATION DATE

| REQUEST CLASS | | 1956 | 1955 | 1954 | 1953 | 1952 | 1951 | 1950 | 1949 | 1948 | 1947 | 1946 | PRE-1946 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FICTION | (813+823) | 6 | 2 | 5 | 9 | 4 | 7 | 6 | 5 | 3 | 5 | 3 | 67 | 1102 |
| GENERAL | (001-099) | 1 | 1 | 1 | 4 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 12 | 202 |
| PHILOSOPHY | (100-299) | 1 | 1 | 4 | 1 | 2 | 4 | 3 | 0 | 3 | 1 | 1 | 19 | 245 |
| PSYCHOLOGY | (130-159) | 0 | 2 | 3 | 2 | 2 | 0 | 2 | 2 | 2 | 1 | 1 | 13 | 299 |
| SOCIAL SCI | (300-369) | 1 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 335 |
| POLTCL SCI | (320-659) | 3 | 1 | 0 | 1 | 2 | 1 | 2 | 1 | 2 | 0 | 0 | 10 | 455 |
| EDUCATION | (370-379) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 127 |
| LANGUAGE | (400-499) | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 32 |
| ENG-SCI | (310-699) | 0 | 1 | 1 | 3 | 0 | 1 | 4 | 3 | 1 | 0 | 0 | 20 | 312 |
| LIFE SCI | (560-639) | 1 | 1 | 0 | 0 | 1 | 2 | 2 | 1 | 1 | 0 | 1 | 2 | 145 |
| MEDICL SCI | (610-619) | 1 | 0 | 2 | 3 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 8 | 529 |
| HOME ECON | (390-649) | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 5 | 192 |
| ARTS | (700-779) | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 6 | 312 |
| MUSIC | (780-789) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 3 | 79 |
| RECREATION | (790-799) | 3 | 1 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 204 |
| LITERATURE | (800-899) | 2 | 0 | 0 | 1 | 0 | 2 | 2 | 2 | 1 | 0 | 0 | 15 | 182 |
| HISTORY | (900-999) | 9 | 3 | 1 | 1 | 4 | 1 | 3 | 2 | 2 | 3 | 1 | 41 | 366 |
| BIOGRAPHY | (920-929) | 5 | 4 | 4 | 3 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 16 | 272 |
| TOTAL PER YEAR | | 35 | 23 | 26 | 31 | 16 | 21 | 31 | 22 | 16 | 13 | 10 | 248 | 5390 |

Table C.1 March Demand by Publication Date and Dewey Class

| REQUEST CLASS | | PUBLICATION DATE 1978 | 1977 | 1976 | 1975 | 1974 | 1973 | 1972 | 1971 | 1970 | 1969 | 1963 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FICTION | (813+823) | 1 | 4 | 0 | 1 | 0 | 1 | 2 | 2 | 0 | 0 | 0 |
| GENERAL | (001-099) | 5 | 6 | 11 | 3 | 2 | 6 | 3 | 7 | 12 | 0 | 3 |
| PHILOSOPHY | (100-299) | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| PSYCHOLOGY | (130-159) | 1 | 3 | 1 | 3 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| SOCIAL SCI | (300-369) | 0 | 0 | 1 | 1 | 0 | 2 | 5 | 0 | 0 | 2 | 0 |
| POLTCL SCI | (320-659) | 0 | 14 | 8 | 8 | 2 | 1 | 4 | 3 | 1 | 1 | 1 |
| EDUCATION | (370-379) | 0 | 5 | 6 | 2 | 2 | 0 | 1 | 5 | 0 | 1 | 0 |
| LANGUAGE | (400-499) | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENG-SCI | (310-699) | 1 | 19 | 5 | 2 | 3 | 4 | 2 | 1 | 1 | 0 | 0 |
| LIFE SCI | (560-639) | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| MEDICL SCI | (610-619) | 2 | 35 | 16 | 7 | 9 | 4 | 0 | 1 | 1 | 1 | 0 |
| HOME ECON | (390-649) | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| ARTS | (700-779) | 0 | 3 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| MUSIC | (780-789) | 0 | 0 | 1 | 0 | 4 | 0 | 1 | 0 | 1 | 0 | 0 |
| RECREATION | (790-799) | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| LITERATURE | (800-899) | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 1 | 2 | 0 | 0 |
| HISTORY | (900-999) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| BIOGRAPHY | (920-929) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL PER YEAR | | 12 | 96 | 58 | 33 | 24 | 21 | 20 | 21 | 19 | 7 | 5 |

Table C.2 March 1978 Photocopy Requests by Publication Date and Dewey Class (Continued)

| REQUEST CLASS | | PUBLICATION DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1967 | 1966 | 1965 | 1964 | 1963 | 1962 | 1961 | 1960 | 1959 | 1958 | 1957 |
| FICTION | (813+823) | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| GENERAL | (001-099) | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 4 | 0 | 1 | 2 |
| PHILOSOPHY | (100-299) | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| PSYCHOLOGY | (130-159) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SOCIAL SCI | (300-369) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| POLTCL SCI | (320-659) | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 0 |
| EDUCATION | (370-379) | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| LANGUAGE | (400-499) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENG-SCI | (310-699) | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 1 | 1 | 0 |
| LIFE SCI | (560-639) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| MEDICL SCI | (610-619) | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| HOME ECON | (390-649) | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| ARTS | (700-779) | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MUSIC | (780-789) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| RECREATION | (790-799) | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| LITERATURE | (800-899) | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 |
| HISTORY | (900-999) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BIOGRAPHY | (920-929) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL PER YEAR | | 6 | 5 | 10 | 3 | 4 | 5 | 3 | 8 | 2 | 10 | 3 |

Table C.2 March 1978 Photocopy Requests by Publication Date and Dewey Class (Continued)

| | | PUBLICATION DATE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REQUEST CLASS | | 1956 | 1955 | 1954 | 1953 | 1952 | 1951 | 1950 | 1949 | 1948 | 1947 | 1946 | PRE-1946 | TOTAL |
| FICTION | (813+823) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| GENERAL | (001-099) | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 82 |
| PHILOSOPHY | (100-299) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11 |
| PSYCHOLOGY | (130-159) | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 15 |
| SOCIAL SCI | (300-369) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 13 |
| POLTCL SCI | (320-659) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| EDUCATION | (370-379) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 25 |
| LANGUAGE | (400-499) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| ENG-SCI | (310-699) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 58 |
| LIFE SCI | (560-639) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| MEDICL SCI | (610-619) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 82 |
| HOME ECON | (390-649) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| ARTS | (700-779) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 11 |
| MUSIC | (780-789) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| RECREATION | (790-799) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| LITERATURE | (800-899) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| HISTORY | (900-999) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| BIOGRAPHY | (920-929) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| TOTAL PER YEAR | | 1 | 4 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 27 | 412 |

Table C.2 March 1978 Photocopy Requests by Publication Date and Dewey Class

| REQUEST CLASS | | PUBLICATION DATE 1978 | 1977 | 1976 | 1975 | 1974 | 1973 | 1972 | 1971 | 1970 | 1969 | 1968 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FICTION | (813+823) | 103 | 284 | 151 | 73 | 59 | 30 | 35 | 41 | 20 | 19 | 27 |
| GENERAL | (001-099) | 9 | 31 | 17 | 11 | 8 | 5 | 6 | 3 | 4 | 2 | 0 |
| PHILOSOPHY | (100-299) | 10 | 41 | 13 | 17 | 14 | 12 | 15 | 8 | 7 | 10 | 12 |
| PSYCHOLOGY | (130-159) | 18 | 59 | 33 | 23 | 13 | 12 | 15 | 17 | 12 | 14 | 7 |
| SOCIAL SCI | (300-369) | 26 | 81 | 53 | 22 | 23 | 16 | 13 | 10 | 12 | 10 | 3 |
| POLTCL SCI | (320-659) | 8 | 106 | 64 | 42 | 38 | 20 | 16 | 10 | 12 | 13 | 8 |
| EDUCATION | (370-379) | 4 | 18 | 14 | 8 | 7 | 4 | 7 | 1 | 5 | 6 | 7 |
| LANGUAGE | (400-499) | 0 | 3 | 1 | 2 | 1 | 2 | 3 | 0 | 0 | 0 | 2 |
| ENG-SCI | (310-699) | 9 | 41 | 33 | 23 | 19 | 11 | 13 | 14 | 8 | 11 | 6 |
| LIFE SCI | (560-639) | 2 | 30 | 9 | 15 | 8 | 8 | 8 | 4 | 9 | 5 | 2 |
| MEDICL SCI | (610-619) | 23 | 122 | 50 | 30 | 47 | 24 | 18 | 16 | 18 | 16 | 14 |
| HOME ECON | (390-649) | 5 | 59 | 22 | 15 | 18 | 14 | 11 | 9 | 1 | 5 | 4 |
| ARTS | (700-779) | 6 | 89 | 45 | 37 | 22 | 16 | 13 | 15 | 9 | 6 | 6 |
| MUSIC | (780-789) | 2 | 9 | 6 | 4 | 8 | 4 | 5 | 5 | 4 | 1 | 4 |
| RECREATION | (790-799) | 12 | 53 | 33 | 17 | 25 | 5 | 6 | 5 | 8 | 3 | 3 |
| LITERATURE | (800-899) | 5 | 18 | 8 | 16 | 5 | 11 | 9 | 10 | 4 | 7 | 6 |
| HISTORY | (900-999) | 29 | 82 | 36 | 24 | 10 | 13 | 9 | 7 | 10 | 5 | 11 |
| BIOGRAPHY | (920-929) | 16 | 52 | 41 | 12 | 17 | 12 | 10 | 10 | 9 | 7 | 10 |
| TOTAL PER YEAR | | 287 | 1178 | 629 | 391 | 342 | 219 | 212 | 185 | 152 | 140 | 132 |

Table C.3 March 1978 Monograph requests by Publication Date and Dewey Class (Continued)

| | | PUBLICATION DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REQUEST CLASS | | 1967 | 1966 | 1965 | 1964 | 1963 | 1962 | 1961 | 1960 | 1959 | 1958 | 1957 |
| FICTION | (813+823) | 26 | 13 | 12 | 9 | 7 | 9 | 9 | 13 | 4 | 11 | 9 |
| GENERAL | (001-099) | 1 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 |
| PHILOSOPHY | (100-299) | 4 | 5 | 2 | 11 | 3 | 2 | 2 | 2 | 3 | 2 | 4 |
| PSYCHOLOGY | (130-159) | 3 | 3 | 6 | 4 | 6 | 2 | 4 | 3 | 1 | 1 | 1 |
| SOCIAL SCI | (300-369) | 11 | 6 | 5 | 9 | 4 | 3 | 1 | 2 | 1 | 2 | 4 |
| POLTCL SCI | (320-659) | 11 | 6 | 7 | 4 | 3 | 3 | 6 | 4 | 1 | 2 | 0 |
| EDUCATION | (370-379) | 3 | 1 | 3 | 2 | 0 | 0 | 2 | 3 | 2 | 0 | 0 |
| LANGUAGE | (400-499) | 0 | 1 | 0 | 1 | 0 | 2 | 2 | 0 | 0 | 1 | 0 |
| ENG-SCI | (310-699) | 14 | 7 | 2 | 1 | 6 | 5 | 2 | 4 | 1 | 3 | 0 |
| LIFE SCI | (560-639) | 3 | 10 | 3 | 2 | 3 | 1 | 1 | 0 | 2 | 1 | 1 |
| MEDICL SCI | (610-619) | 3 | 8 | 6 | 5 | 3 | 2 | 6 | 15 | 3 | 0 | 1 |
| HOME ECON | (390-649) | 3 | 2 | 2 | 2 | 2 | 0 | 0 | 1 | 0 | 1 | 1 |
| ARTS | (700-779) | 6 | 5 | 2 | 5 | 1 | 1 | 1 | 2 | 0 | 2 | 1 |
| MUSIC | (780-789) | 2 | 2 | 1 | 2 | 0 | 2 | 3 | 0 | 0 | 0 | 1 |
| RECREATION | (790-799) | 2 | 1 | 3 | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 0 |
| LITERATURE | (800-899) | 6 | 3 | 3 | 7 | 6 | 6 | 1 | 5 | 1 | 3 | 5 |
| HISTORY | (900-999) | 7 | 12 | 4 | 5 | 3 | 7 | 3 | 10 | 3 | 2 | 1 |
| BIOGRAPHY | (920-929) | 3 | 5 | 3 | 8 | 3 | 2 | 2 | 6 | 4 | 0 | 3 |
| TOTAL PER YEAR | | 108 | 91 | 65 | 78 | 51 | 51 | 46 | 71 | 30 | 32 | 33 |

Table C.3 March 1978 Monograph Requests by Publication Date and Dewey Class
(Continued)

PUBLICATION DATE

| REQUEST CLASS | | 1956 | 1955 | 1954 | 1953 | 1952 | 1951 | 1950 | 1949 | 1948 | 1947 | 1946 | PRE-1946 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FICTION | (813+823) | 6 | 2 | 5 | 9 | 4 | 7 | 6 | 5 | 3 | 5 | 3 | 67 | 1086 |
| GENERAL | (001-099) | 1 | 0 | 1 | 2 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 8 | 120 |
| PHILOSOPHY | (100-299) | 1 | 0 | 4 | 1 | 2 | 4 | 3 | 0 | 3 | 1 | 1 | 15 | 234 |
| PSYCHOLOGY | (130-159) | 0 | 2 | 3 | 1 | 2 | 0 | 1 | 2 | 2 | 1 | 1 | 12 | 284 |
| SOCIAL SCI | (300-369) | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 322 |
| POLTCL SCI | (320-659) | 2 | 1 | 0 | 1 | 2 | 1 | 2 | 1 | 2 | 0 | 0 | 10 | 406 |
| EDUCATION | (370-379) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 102 |
| LANGUAGE | (400-499) | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 26 |
| ENG-SCI | (310-699) | 0 | 1 | 1 | 3 | 0 | 1 | 4 | 3 | 1 | 0 | 0 | 7 | 254 |
| LIFE SCI | (560-639) | 1 | 1 | 0 | 0 | 1 | 2 | 2 | 1 | 1 | 0 | 1 | 2 | 139 |
| MEDICL SCI | (610-619) | 1 | 0 | 2 | 3 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 6 | 447 |
| HOME ECON | (390-649) | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 5 | 185 |
| ARTS | (700-779) | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 5 | 301 |
| MUSIC | (780-789) | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 3 | 71 |
| RECREATION | (790-799) | 3 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 196 |
| LITERATURE | (800-899) | 2 | 0 | 0 | 1 | 0 | 2 | 2 | 2 | 1 | 0 | 0 | 15 | 170 |
| HISTORY | (900-999) | 9 | 3 | 1 | 1 | 4 | 1 | 3 | 2 | 2 | 3 | 1 | 41 | 364 |
| BIOGRAPHY | (920-929) | 5 | 4 | 4 | 3 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 16 | 271 |
| TOTAL PER YEAR | | 34 | 19 | 26 | 28 | 16 | 21 | 29 | 22 | 16 | 13 | 10 | 221 | 4978 |

Table C.3 March 1978 Monograph Requests by Publication Date and Dewey Class

# APPENDIX D:

## Transition Probabilities for SLS Intralibrary Model by Request Classes

A discussion of transition probabilities for the SLS intralibrary model occurs in Chapter Three under the section Model of Intralibrary Processing. The transition probabilities between processing activities are given for all requests in Table 3.4. The table in this appendix provides analysis of the data by subject class. Probabilities are given for transitioning between 2 nodes. The node pairs are indicated by the following numbers:

1-2 basic search to forward search
1-3 basic search to verify
1-4 basic search to purchase search and purchase decision
1-5 basic search to obtain
1-6 basic search to reserve
2-8 forward search to forward
3-2 verify to forward search
3-4 verify to purchase search and purchase decision
3-5 verify to obtain
3-6 verify to reserve
4-7 purchase search and purchase decision to purchase
5-8 obtain and forward unsatisfied request
5-9 obtain and send document
6-8 reserve and forward unsatisfied request
6-9 reserve and send document
7-8 purchase and forward unsatisfied request
7-9 purchase and send document

| CLASS | TRANSITION PROBABILITIES | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-2 | 1-3 | 1-4 | 1-5 | 1-6 | 2-8 | 3-2 | 3-4 | 3-5 | 3-6 | 4-7 | 5-8 | 5-9 | 6-8 | 6-9 | 7-8 | 7-9 |
| FICTION (813+823) | .733 | .148 | .009 | .063 | .047 | 1.0 | .670 | .291 | .025 | .015 | 1.0 | .011 | .989 | .045 | .955 | .125 | .875 |
| GENERAL (001-099) | .677 | .174 | - | .123 | .026 | 1.0 | .805 | .171 | - | .024 | 1.0 | .034 | .966 | - | 1.0 | .143 | .857 |
| PHILOSOPHY (100-299) | .579 | .337 | .007 | .042 | .035 | 1.0 | .802 | .167 | .010 | .021 | 1.0 | - | 1.0 | .250 | .750 | .222 | .778 |
| PSYCHOLOGY (130-159) | .571 | .252 | .003 | .090 | .084 | 1.0 | .774 | .179 | .012 | .036 | 1.0 | .065 | .935 | .065 | .935 | .250 | .750 |
| SOCIAL SCI (300-369) | .639 | .216 | .008 | .065 | .073 | 1.0 | .763 | .188 | .025 | .025 | 1.0 | .038 | .962 | .103 | .897 | .333 | .667 |
| POLTCL SCI (320-659) | .623 | .246 | .010 | .056 | .066 | 1.0 | .874 | .087 | .031 | .008 | 1.0 | .061 | .939 | .086 | .914 | .188 | .813 |
| EDUCATION (370-379) | .636 | .294 | - | .056 | .014 | 1.0 | .810 | .190 | - | - | 1.0 | - | 1.0 | - | 1.0 | - | 1.0 |
| LANGUAGE (400-499) | .514 | .429 | - | - | .057 | 1.0 | .933 | .067 | - | - | 1.0 | - | - | - | 1.0 | - | 1.0 |
| SCI-ENG (310-699) | .675 | .292 | .008 | .019 | .006 | 1.0 | .771 | .229 | - | - | 1.0 | - | 1.0 | - | 1.0 | .074 | .926 |
| LIFE SCI (560-639) | .727 | .209 | .012 | .029 | .023 | 1.0 | .806 | .167 | - | .028 | 1.0 | - | 1.0 | .200 | .800 | .125 | .875 |
| MEDICL SCI (610-619) | .613 | .183 | .002 | .060 | .143 | 1.0 | .832 | .121 | .009 | .037 | 1.0 | .028 | .972 | .182 | .818 | .143 | .857 |
| HOME ECON (390-649) | .637 | .219 | .005 | .074 | .065 | 1.0 | .681 | .255 | .021 | .043 | 1.0 | - | 1.0 | .063 | .938 | .077 | .923 |
| ARTS (700-779) | .614 | .278 | .023 | .048 | .037 | 1.0 | .765 | .224 | .010 | - | 1.0 | .056 | .944 | .077 | .923 | .200 | .800 |
| MUSIC (780-789) | .663 | .269 | - | .058 | .010 | 1.0 | .786 | .214 | - | - | 1.0 | - | 1.0 | - | 1.0 | .167 | .833 |
| RECREATION (790-799) | .679 | .175 | .004 | .104 | .038 | 1.0 | .595 | .310 | .071 | .024 | 1.0 | .179 | .821 | .100 | .900 | - | 1.0 |
| LITERATURE (800-899) | .640 | .304 | - | .032 | .024 | 1.0 | .895 | .079 | - | .026 | 1.0 | - | 1.0 | .125 | .875 | .167 | .833 |
| HISTORY (900-999) | .644 | .296 | .007 | .042 | .011 | 1.0 | .880 | .090 | .023 | .008 | 1.0 | .136 | .864 | .333 | .667 | .133 | .867 |
| BIOGRAPHY (920-929) | .380 | .514 | - | .053 | .053 | 1.0 | .886 | .068 | .028 | .018 | 1.0 | - | 1.0 | .059 | .941 | .263 | .737 |

Table D.1: Requests Processed Within SLS - Probability of Requests Transitioning Between Processing Activities by Subject Class